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A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

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HACK SAWS.

GOODELL

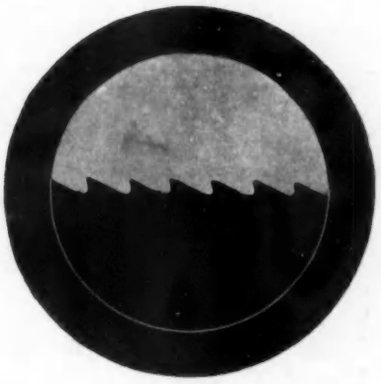
GOODELL

Magnified Teeth of GOODELL Hack Saw Blade

BEFORE

Being Used.

Before



TRADE MARK G ON EVERY BLADE.

This little object lesson carries its own moral. Magnified photographs do not lie, they show the exact condition of this Blade before and after using. A careful scrutiny of the teeth will show them still in GOOD condition. We make them in a great variety of lengths and with either 14, 20 or 32 teeth to the inch.

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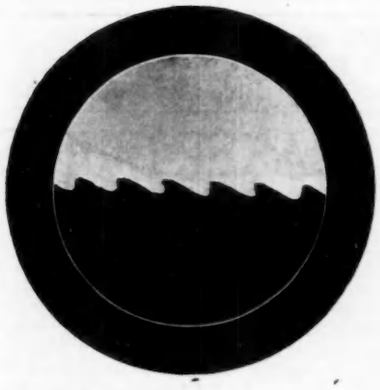

After

TRADE MARK G ON EVERY BLADE.

Magnified Teeth of Same Blade

AFTER

Cutting Off 157 Pieces of 15-16" Steel.

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GREENFIELD, MASS., U. S. A.

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of "pretty fair" planers—the kind that do "pretty fair" work. But not everybody wants that kind, and there are enough people who want the best, to keep Whitney good and busy all the time.

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Winchendon, Mass.
U. S. A.

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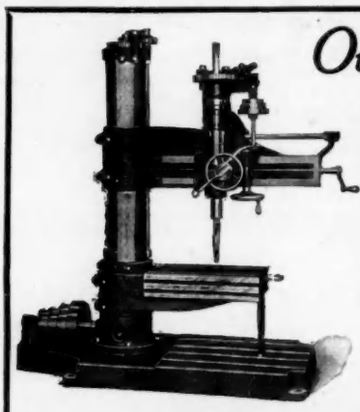

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costs least, though it's of a kind that's priceless—that money cannot buy. It's the-word-of-mouth advertisement which the friends (all users) of Bickford Radials publish to their friends—their cordial, willing tribute to Bickford Radial superiority.

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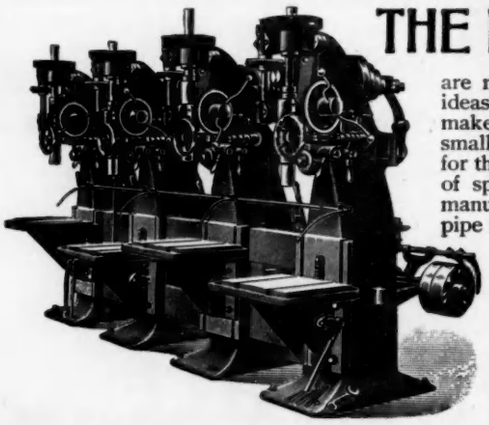

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Cold Saw Cutting Off Machines,
Boring Machines,
Electric Driven Portable Machines,
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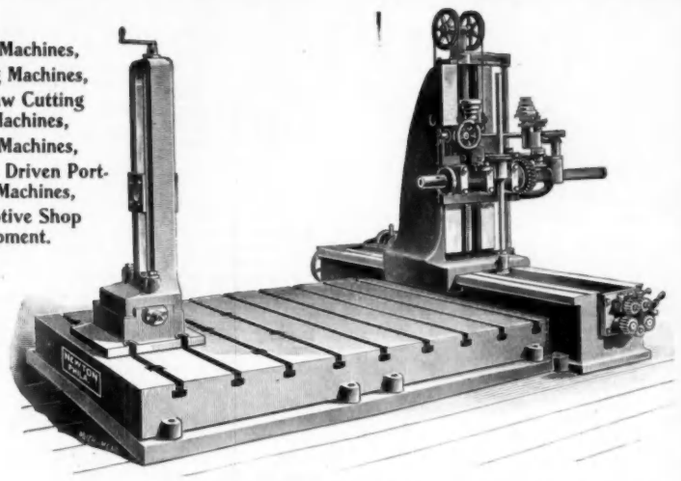

Horizontal Floor Boring and Milling Machines, No. 1 with 4¼″ Spindle, No. 2 with 5½″ Spindle.

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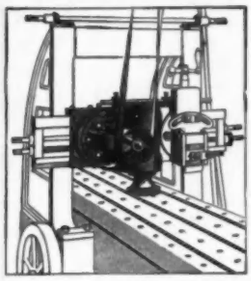

combined with any

Iron Planer

swivels from Horizontal to Vertical.
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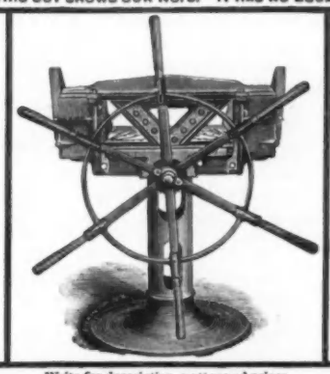
For Pattern Makers and all Wood Workers.
OLIVER'S PATENTS. ALL STYLES AND SIZES
THIS CUT SHOWS OUR NO. 3. IT HAS NO EQUAL.



Write for descriptive matter and prices.
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GRAND RAPIDS, MICH., U. S. A.
British Agents: G. W. Burton, Griffiths & Co., London.

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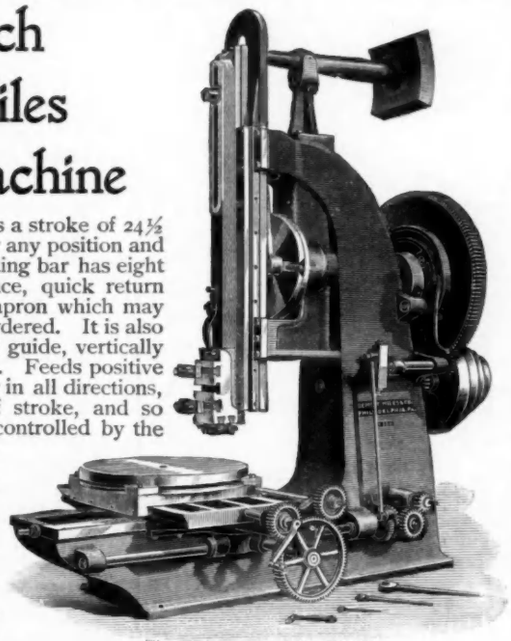

24 INCH SLOTTING MACHINE

has a stroke of 24½ inches, with adjustment for any position and length of movement. Cutting bar has eight speeds, with counterbalance, quick return motion, and a tool relief apron which may be made automatic, if so ordered. It is also provided with a reinforcing guide, vertically adjustable to suit the work. Feeds positive by variable cam, self-acting in all directions, operating at upper end of stroke, and so arranged that all can be controlled by the workman from one position. Distance from front of cutting bar to inside of frame, 43 inches, affording space for the key-seating of a 96-inch wheel. Compound tables have an adjustment of 60 inches longitudinally, and 48 inches transversely; and support a revolving rectangular table 50 inches in diameter, or 62 inches across the corners, which may be fixed in position by corner clamps, when circular feeds are not in use. Countershaft and wrenches included.

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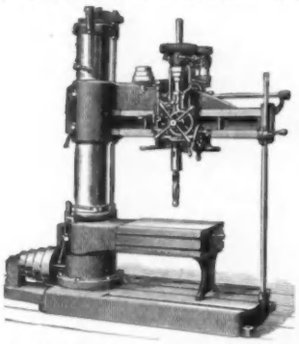

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Lieber's and A B C Codes.

The Advancement of Apprentices.

Of the many remarks made in the discussion of Mr. Higgins' paper on the education of machinists, foremen and mechanical engineers at the recent meeting of the American Society of Mechanical Engineers, few were more suggestive or appropriate than those of Mr. Christie. They were reported in our issue of last week, and it will be remembered that in describing the very enlightened treatment of apprentices at the Pencoyd Iron Works Mr. Christie gave it as his opinion that the keeping of a boy at the dull routine of operating some one machine is due, more than anything else, "to the inertia of the foremen," and that the real interests of the employer lie with the advancement of the boys through the opposite course.

While the inertia of the foremen may be, in some cases, the immediate cause of the too common practice, it is not usually, we think, the ultimate cause, and we do not think it just to require the foremen to carry the blame. That the position of a foreman is a difficult and perplexing one every one knows, and to the fact the paper and its discussion bear ample evidence. It must be remembered that before everything else, his business is to see that the work is turned out. From this standpoint there can be no doubt that the immediate interests of the employer demand that every employee be kept at the work with which he is familiar, which, in the case of the apprentice boy may be cutting bolts or operating a drill press. The foreman is not charged with the furtherance of his employer's interests in a large way; he is charged with getting out the work in hand. Is it strange that he adopts the course best suited to accomplish the results which he is expected to accomplish? Is it not, in fact, unreasonable to expect him to adopt any other?

While we fully believe with Mr. Christie, that the employer will in the end gain more through the advancement of the boy than through the opposite course, it must be remembered that that gain is remote. So far as the work in hand is concerned, it is best furthered by keeping the boy at what he already understands. Add to this the increased attention demanded by a boy when placed on work which is new to him, attention for which the foreman can ill afford the time in the midst of his many duties and perplexities, and it is clear that there are many reasons besides mere inertia why he should do as he does. There can, in fact, be no doubt that in cases where the employer is not broad minded enough to realize the ultimate gain due to the boy's advancement, bearing in mind that the immediate gain due to the opposite course is as plain to him as to anyone else, the foreman would be censured for changing the boy about. One can easily imagine the fine scorn with which many an employer would greet such an effort to advance what appear to him to be the boy's interests at the expense of what he considers to be his own, or to advance his own interests through what he considers a finely spun theory with which he has no sympathy.

In other words, the method followed by Mr. Christie is necessarily a feature of the policy to be adopted by the management. No matter how clearly the foreman may see the ultimate advantages of such a policy, he is powerless to adopt it of his own volition. There is, in fact, an absolute conflict between the ultimate interest of the employer and the duty which he lays upon his foreman. Regardless of how enlightened the employer may be, the ever present necessity of immediate dispatch which confronts the foreman can have no other effect than to impel him to adopt, so far as possible, such measures as will accomplish the results expected of him. The employer is the man who must usually see the advantage of the enlightened course, if it is to be followed in any case.

Trans-shipment of Machinery in the Port of New York.

There is, we think, some just cause for complaint of the manner in which shipments of machinery coming from the West and destined for European ports are handled in trans-shipment from cars to steamers in the port of New York.

When any single package approaches what would be called heavy, it must be handled by a "lighter," by which is meant a harbor boat which carries its load upon its single deck and is usually provided with hoisting apparatus. This lighter, if steam propelled, goes to the railway terminus on the west shore of the Hudson river, gets the machine and takes it to the steamer. The charges for this are always heavy ($15 is the minimum), and in case anything happens, such as a destructive fall, the owner of the machine finds that no one can be held responsible. The railroad company claims that its duty is done when the machine is delivered to the lighter; the steamship company has not yet received it, and for one reason or another the owners of the lighter cannot be made to pay for the loss.

It would seem as though some of the leading roads at least, that already have so much floating equipment in the harbor —tugboats, car-floats and ferryboats— could arrange things better than this. The Pennsylvania road, for instance, brings many carloads of machinery from the West every week. Why should it not provide for itself the facilities for delivering this machinery upon the steamship dock or upon the steamer itself. The present method is a handicap upon foreign business in heavy machine tools, and this business would seem to be important enough to justify the provision of equipment for handling it in the best possible manner.

Machinery in the New Reciprocity Treaties.

The President has forwarded to Congress the various reciprocity treaties consummated last summer, in order that they may now be ratified by the Senate. According to their terms, the following changes have been made affecting exports of machinery:

In the Barbadoes treaty, dated June 16, 1899, it is provided that machinery for electric lighting, and wire fencing shall be imported from the United States free of duty; while hardware and cutlery are subject to a duty not exceeding 5 per cent. of their value.

The treaty with British Guiana, signed on July 18, provides for the free entry from the United States of machinery for electric lighting, machinery and implements for mining, for agriculture and for the manufacture of sugar, and wire fencing; metallic hardware and cutlery, 5 per cent. ad valorem.

The Turks and Caicos Islands treaty, signed July 21, gives free entry to American sewing machines, iron, steel, copper, and all manufactures of same, except hardware and cutlery; also machinery of all kinds. Hardware and cutlery would be subject to a duty of 10 per cent. ad valorem.

In the Jamaica treaty, which was signed on July 22, the following items are to be entered free of duty when imported from the United States:

1. Agricultural implements and tools, namely: plows, harrows, cultivators, graders, horse hoes, hoes, cutlasses, agricultural forks, axes, bill hooks, clod crushers, dibbles, sowing machines, stump extractors, scythes, shovels, picks and spades.

2. Apparatus and appliances of all kinds for generating, storing, conducting, converting into power or light and measuring electricity, including telegraphic, telephonic and electrical appliances of all kinds for communication and illumination.

3. Apparatus and appliances for generating, measuring, conducting and storing gas.

Belting for machinery of leather, canvas or india rubber. Bridges of iron or wood. Fire engines and fire extinguishers.

Locomotives, railway rolling stock and parts thereof, rails, railway ties, and all material and appliances to be used exclusively for construction, equipment and operation of railways and tramways.

Sewing machines.

Steam engines, boilers, prime motor engines of all kinds, machines, machinery and apparatus, whether stationary or portable, worked by power or by hand, for manufacturing or preparing for market the agricultural, mineral and other products of the island.

Steel ingots.

Telephones and telephone switchboards.

Wire fencing and all appurtenances for same.

The Bermuda convention, signed on July 24, provides for the free entry into that island of all vessels, dredges, boats, machinery, tools, plants of materials for survey or improvement of ship channels under control of the island government, also implements of agriculture and wire fencing.

The treaty of France, which is the result of a convention signed on July 24. By its provisions all goods imported into France and Algeria from the United States are admitted under the minimum rates of the French tariff, with the exception of the following articles: Cast iron, belts, cords, and other leather articles manufactured for machinery, dynamos, machine tools, dynamo conductors and parts.

In return we agree to admit, among other items, cutlery at a reduction of 10 per cent.; nails, spikes, points, etc., at 15 per cent.; unenumerated articles made in whole or chiefly of metal, 10 per cent. of the present duties, as set forth in our tariff act of July 24, 1897.

A. F. TENNILLE.

The Hollow Shaft of the "Helena."

Editor American Machinist:

We note the following item on page 1178-30 of your December 14 issue:

"Examination of the Board of Survey of the hollow forged propeller shaft of the U. S. S. 'Helena,' which was ruptured some time ago, showed the axial hole was 17-32 inch out of center, making thickness of metal one one side 1 29-32 inches, while on the opposite side it was only 17-32 inch."

We doubt very much if this small shaft was "hollow forged" by the process of forging hollow on a mandrel, as that process is practiced by the Bethlehem Steel Company only in this country, and as the shaft was not made by this company. We make mention of this to you, inasmuch as the Bethlehem Steel Company is identified with the hollow forging process, and it might lead some of your readers to think that the inaccuracies shown as occurring in this shaft were due to poor methods of manufacture under the process named.

H. F. J. PORTER.

Photographs of Machines Wanted.

Large and good photographs of machine tools and other machines are wanted suitable for framing and for the adornment of the London office of the "American Machinist." They may be sent to The American Machinist, Oswaldestre House, 34 Norfolk street, Strand, W. C., London.

Expansion of Thick Cylinders, Etc.

In the article by Mr. Dunbar on the above subject, on page 1156, an error occurs, just below Fig. 2, where the types say, "At 1½ inches per minute the resistance was maximum." The figure written by Mr. Dunbar was 1-12 inch, instead of 1½ inches.

Secretary Long of the navy proposes a consolidation of what are known as the Bureaus of Construction and Repair, Equipment and Steam Engineering. His proposal has been embodied in the form of a bill which it is evidently the purpose to pass during the present session of Congress. The duties of the new bureau will be those previously performed by the three bureaus abolished. It will be divided into two divisions, one of construction and the other of machinery. Selection of the chief of the bureau is to be made from the list of line officers or naval constructors not below the grade of commander. The chief of the division of construction must be a naval constructor, and the chief of the division of machinery must be a line officer who has had engineering experience.

It is said that a great deal of copper and iron ore is expected to be shipped during the coming year to Philadelphia from Cuba and from European ports, and it is reported that 200,000 tons of iron ore have been engaged for shipment from Spanish and other Mediterranean ports, the present indications being that American iron ore cannot be gotten out in sufficient quantities to nearly supply the probable home demand for the coming year.

Dr. Benjamin, of New York, who takes an interest in automobile affairs, says there are a number of them to be seen on the streets of St. Petersburg and Moscow, and that they are propelled by power derived from alcohol. He states that the fuel used can be made at a cost as low as 8 cents per gallon, and that for this reason it is economical there, although here, in this blessed land of freedom, the internal revenue taxes upon such alcohol would be about 90 cents a gallon, and would effectually prevent its use for the purpose.

On Wednesday, December 20, at the University of Pennsylvania, Philadelphia, there took place the formal opening of the Free Museum of Science and Art, on which occasion the "Dr. William Pepper Testimonial Committee," through the Hon. George F. Edwards, presented to the provost and trustees of the university a statue of the late Dr. William Pepper.

The yearly index for 1899 will be inclosed to all mail subscribers with the second issue of 1900. All other readers or whoever desires a copy of the index can obtain it free of cost by sending a postal-card request.

Commercial Review.

NEW YORK, SATURDAY EVENING,
December 16, 1899.

ENGINEERING MATTERS.

The chief item of local electrical news which we have to announce this week is the award of the big dynamo contract for the "Waterside" power station of the New York Light, Heat and Power Company to the General Electric Company. The New York Light, Heat and Power Company is the title of the combine formed about a year ago on the basis of the New York Edison Electric Illuminating and other concerns. It may be remembered that the contract for the boiler equipment of the plant was secured by Thayer & Co., for execution by the Aultman & Taylor Company, while eight Westinghouse engines, of 5,500 horse-power each, were ordered later. The size of the generator contract may be inferred from these figures.

Less than the usual tapering of engine trade noticeable at this season characterizes the close of the phenomenal year 1899. Holiday influences are attracting little attention, and demand keeps on practically unabated. Prospective business in all lines of engine work maintains its due proportions, so as to promise a duplication of this year's trade in next, or rather in the first six months of it. What the latter half of 1900 will be, commercially, it is useless to speculate, for much will depend upon the issues of the Presidential campaign.

Deliveries are in some cases reported as a trifle easier than they were earlier in the year. This might indicate that the volume of orders is growing smaller, and, indeed, may be due in part to the sudden spurt of trade having subsided to a steady flow, yet there are other explanations for it, such as increased facilities and rather more plentiful raw material. Yet the relief in the matter of deliveries, where it exists, is not enough to be much comfort to buyers who are in a hurry. Six to twelve months is a fair range of deliveries for a 1,000 horse-power engine. An Eastern company lately refused to accept a contract for a 2,000 horse-power engine on less than fourteen months' time. A leading Western company pronounces deliveries more difficult than ever.

Prices have been further advanced since about the beginning of this month by several manufacturers. The Harrisburg Foundry & Machine Company has added about 5 per cent; the Buffalo Forge Company has done the same; Shepherd engines went up 10 per cent. last week, and a Cincinnati concern has made an advance on some lines of engines which went into effect yesterday, and which is expected to be followed by an increase on the other lines about January 1.

The Edward P. Allis Company has secured a contract for three 800 horse-power vertical cross compound condensing engines, to be added to the power plant of the Fairhaven & Westville electric railroad at New Haven, Conn.

The Buffalo Forge Company will send a man to Germany, December 19, to look after the erection of the heating and ventilating plants which the company is to install in the new German Niles and Garvin machine tool manufactories, and to look after other business of the company at the same time.

That contingent of the engine market which looks to the urban building trade to supply much of its patronage is passing under the cloud of an inflated structural material market. The impossibility of erecting steel frame work at other than an exorbitant cost is causing hesitation in building enterprises. We are informed that a certain architect has in his office specifications for nine steel or iron frame buildings, every one of which is held up because of the high price of material. The parties interested are determined to wait for a drop in the market.

The Buffalo Forge Company is now erecting a new factory building, 200x75 feet, six stories high, with such floor carrying capacity as to permit the operation of any tool on any floor. Nevertheless, the building has a wooden framework. The company found that structural steel was selling at fancy prices and for such long deliveries that they, being in a hurry for their new building, could not wait for it. So they decided upon wooden, slow-burning construction, a style of architecture to which, indeed, they were not averse.

The Lidgerwood Manufacturing Company has now on hand about four times the volume of orders usual at this season. The works have been running twenty-two hours a day for a long time past. The most interesting feature of the company's business at present is the successful result of the test of its new specialty, the Miller conveyor for coaling vessels at sea, which was made a few days ago on the battleship "Massachusetts." The company has been having a good demand from Mexico for mining apparatus. Shipment of two mining hoists has been made to that country within a week or so. The injury to South African trade by the war is not considered of any importance, since there is abundance at home to compensate for the loss of the comparatively small percentage that came thence.

Houston, Stanwood & Gamble have sold a 150 horse-power engine to operate a drydock of the Havana Dry Dock Company.

The Philadelphia office of Burhorn & Granger has closed a contract for the installation of a steam plant of about 300 horse-power for the Dodge Coal Storage Company.

The Guggenheim Smelting Company, Perth Amboy, N. J., has ordered a 775 horse-power engine of the Hooven, Owens & Rentschler Company, to be direct connected to a Crocker-Wheeler generator for electrolysis. The Philadelphia & Westchester Traction Company has purchased of the Hooven, Owens & Rentschler Company two 650 horse-power engines, to be direct connected to Westinghouse generators. They will be installed in the power house at Llanerch.

MISCELLANEOUS.

The basis on which orders for machine tools are now sometimes accepted by the manufacturer from the dealer is as follows: Price to be made by manufacturer at beginning of ensuing month; order subject to cancellation by dealer if price not satisfactory. So one of the dealers explains, and he says that this form of contract has been in use since October.

Two lines of manufacturing industry in which there has been a phenomenal quantity of plant construction during the last two or three years are paper and cement. It appears that the cement makers are getting around to the tool builders for equipment of machine shops incidental to their work. A tool seller says he has heard of six or eight of them in the last half year, two or three being in the market at present. They call for a general line of machine tools, probably for repair-shop purposes.

MACHINERY EXPORTS FOR OCTOBER.

The Monthly Summary of Commerce and Finance, compiled by the Bureau of Statistics, United States Treasury Department, shows for October, 1899, ascertained exports of metal-working machinery amounting to $527,156; for October, 1898, $651,256. For September, 1899, they have already been reported at $500,043. For the ten months ending October, 1899, the total was $5,522,864; for the ten months ending October, 1898, $4,742,488.

Electrical machinery exports were: October, 1899, $363,773; October, 1898, $286,818; September, 1899, $262,689; ten months ending October, 1899, $2,454,510; ten months ending October, 1898, $1,939,474.

Pumps and pumping machinery: October, 1899, $175,303; October, 1898, $193,886; September, 1899, $239,512; ten months ending October, 1899, $2,466,014; ten months ending October, 1898, $1,809,167.

Printing presses and parts thereof: October, 1899, $137,350; October, 1898, $66,234; September, 1899, $52,843; ten months ending October, 1899, $788,087; ten months ending October, 1898, $662,491.

Locomotive engines: October, 1899, 31 in number, at $280,398 in aggregate value; October, 1898, 43, at $326,156; September, 1899, 40, at $355,660; ten months ending October, 1899, 437, at $4,272,850; ten months ending October, 1898, 513, at $4,663,849; ten months ending October, 1897, 307, at $2,747,077.

Stationary engines: October, 1899, 71 in number, at $34,287 aggregate value; October, 1898, 44, at $30,552; September, 1899, 95, at $49,363; ten months ending October, 1899, 713, at $387,757; ten

months ending October, 1898, 438, at $309,206.

Boilers and parts of engines: October, 1899, $119,125; October, 1898, $105,285; September, 1899, $110,025; ten months ending October, 1899, $1,136,286; ten months ending October, 1898, $1,007,576.

Sewing machines and parts thereof: October, 1899, $369,505; October, 1898, $181,617; September, 1889, $315,707; ten months ending October, 1899, $3,261,399; ten months ending October, 1898, $2,620,196.

Typewriting machines and parts thereof: October, 1899, $202,453; October, 1898, $178,734; September, 1899, $225,520; ten months ending October, 1899, $2,318,011; ten months ending October, 1898, $1,714,325.

INTERVIEW WITH THE PRESIDENT OF THE NATIONAL CASH REGISTER COMPANY.

In an interview with Pres. J. H. Patterson, of the National Cash Register Company, Dayton, O., who recently returned from a trip of several months in foreign lands, he expresses the opinion that the good times now seen in this country will continue much longer than might be expected were not conditions unusually favorable. American manufacturers have made great progress in reducing the cost of manufactures. This is due to improved machinery resulting from American inventive genius, and is stimulated by the fact that the patent laws here give longer and better protection to the inventor than such laws in foreign countries. This has enabled workmen to receive their present high wages while reducing the cost of products, so that these find a market where they were unable to do so before. We are reaching South Africa, India, and other markets, whose trade in times past was monopolized by the cheap labor products of Europe. The demand for our manufactures is so great that our foreign trade is likely to continue longer than might be expected if it consisted chiefly in the export of agricultural products in competition with Argentine, Australia and other grain-producing countries. Another thing which helps our prestige is the superiority of our naval vessels and guns and gunners, as shown in our victories in Cuba and the Philippine Islands. Mr. Patterson found that American manufactures are received in a manner different from that of a few years ago. Then they were met with doubt, and at times with severe criticism, but they now have a reputation which will insure large sales in the future if the quality of the goods is kept up. In locomotives, bicycles, typewriters and cutlery, American goods have the preference. Our product has the durability of the English manufactures, without being too heavy. It has the lightness, beauty and finish of French goods, without their lack of durability. The requests coming from India, Japan and China seeking the establishment of agencies in those countries are one of the new features of our export trade in all lines of manufacture.

Americans are all the time making improvements, while foreigners hold on to old styles. That fact will in time enable this country to outstrip all others. Mr. Patterson advocates an increase in manual training schools in all directions as likely to do much toward removing some of the troubles connected with our manufacturing industries. When American young men have the opportunities for education that are found in Germany, he argues, America will be further ahead in the race than now. He was much pleased with the Exposition buildings in Paris and with the good work that is being carried forward for American exhibitors by Commissioner General Ferdinand W. Peck, who seems to be the right man in the right place.

CHICAGO MACHINERY MARKET.

Builders of power for machine shops are hardly gaining on their obligations. Whether the engine ordered is for 50 or for 2,000 horse-power, the chances are that the buyer will have to wait for it from one to three months if a small engine, from six to fifteen months if a large one. This would be a serious hardship were all other classes of material and supplies promptly delivered, but the backwardness of shipments in structural material and other iron and steel work entering into construction unfits the engine house for its expected occupant on the specified date of delivery. There have been a number of instances where boilers and engines have been erected without a roof over them. Among some of the larger builders of engines the policy is to avoid rather than seek trade, for events prove that they are not able to produce all the output they had hoped to, unexpected delays and stoppages in production occurring persistently.

Most sellers have their choice of customers, and some are scarcely able to provide for the needs of their old friends with whom they have done business for many years. Inquiries keep coming in without diminution. One representative says that during the past month there have come to his desk an average of six inquiries per day, averaging perhaps 500 horse-power each. This amounts to about 75,000 horse-power for the month. Most of it has to be sent adrift, seeking until it finds some maker who can furnish deliveries nearest those desired. This large volume of work is mainly for additional power to large plants now in operation. There seems to be no end of it in sight. December is usually so dull in the closing of contracts of this nature that it is difficult to correctly estimate the weight of the trade. If it is largely anticipatory in character, January and February transactions may be little better than now. If there is to come a still further increase in the demand, deliveries must drift hopelessly behind.

The Deering Harvester Company has just bought from the E. P. Allis & Co. a third 2,000 horse-power engine for its central plant, delivery to be made late next year. There will be six units of that size, according to plans now made. The McCormick Harvesting Machine Company is installing the first engine of six, aggregating about 6,000 horse-power, in its new shops now under construction. Owners of the Penobscot iron mine, at Hibbing, Minn., have bought large pumps from the Prescott Steam Pump Company, Milwaukee, Wis., and three 250 horse-power boilers from Wickes Bros., Saginaw, Mich. The Babcock & Wilcox Company has sold to the Carnegie Steel Company five boilers of about 600 horse-power each for the large freighters now under construction for service on the great lakes. Ide & Co. have sold two engines of 300 horse-power to the Postum Cereal Company, Battle Creek, Mich., and the Wickes Bros. a 150 horse-power boiler to the Morden Frog and Crossing Works, Chicago. E. P. Allis Company sold a 2,000 horse-power engine to the Toledo (Ohio) Traction Company.

There is a notable activity in the sale of air compressors for shop work. This power is finding new uses, and orders are becoming more frequent.

Quotations.

NEW YORK, Monday, Dec. 18, 1899.

Iron—American Pig, tidewater delivery in 1900:—

Pennsylvania Irons:	
No. 1 X foundry	$24 65 @ $25 65
No. 2 X foundry	23 15 @ 24 15
No. 2 plain	22 15 @ 23 15
Alabama Irons:	
No. 1 foundry	22 50 @ 23 00
No. 2 foundry	21 50 @ 22 00
No. 3 foundry	20 50 @ 21 00
No. 1 soft	22 50 @ 23 00
No. 2 soft	21 50 @ 22 00
Foundry forge	20 25 @ 20 75

Bar Iron — Base sizes — Refined, mill price on dock, 2.25 @ 2.36c.; store price, 2.60c.; common from store, 2.50 @ 2.60c.

Tool Steel—Base sizes—Standard quality, 7 @ 8c.; extra grades, 12 @ 14c.; special grades, 16c. and upward.

Machinery Steel—Base sizes—Ordinary brands from store, 2.90 @ 3c.

Cold Rolled Steel Shafting—Base sizes—From store, 4 @ 4¼c. in small lots.

Copper—Lake Superior ingot, 16¾c.; electrolytic, 16⅛ @ 16¼c.; casting copper, 16 @ 16⅛c.

Pig Lead—Wholesale lots, 4.65c. for December, 4.70c. for January; carloads, .02½c. higher. Corroding quality, 4.80c., wholesale.

Pig Tin—In 5 and 10-ton lots, f. o. b., New York, 25¼ @ 25½c.

Spelter—Prime Western, 4⅝ @ 4¾c.

Antimony—In cask lots or over, Cookson's, 10.90 @ 11¼c.; Hallett's, 9¾ @ 9⅞c.; United States, 10c.

Lard Oil—Prime City, present make, 44 @ 47c. in jobbing lots.

A Much Extended Planer Tool.

BY OBERLIN SMITH.

It is a common experience with all machinists running that most useful device, yclept a planer, that the nose or horizontal part of the ordinary tool, carrying the cutting edge at its front end, will not reach far enough forward to extend into apertures in the work of any considerable depth. To meet such cases certain tools are forged with long noses, until the same become too springy to be consistent with a due degree of usefulness. Then heavy L-shaped forgings or castings, with a small cutting tool inserted through the outer end, are usually extemporized for some particular job, the same, of course, being bolted to the tool-slide of the planer by the ordinary clamps, if possible, or otherwise by some extraordinary means.

The writer long ago found out the difficulty of making such tool-holders sufficiently stiff to fasten them to the planer with enough rigidity, especially when planing completely through the frame castings of such machines as power presses, etc., where a length of from one to three feet had to be planed with columns extending upward at each side thereof. These columns would of course strike the cross-slide before any ordinary tool had gone but a little way through the arch-like opening, the bottom of which was to be operated upon.

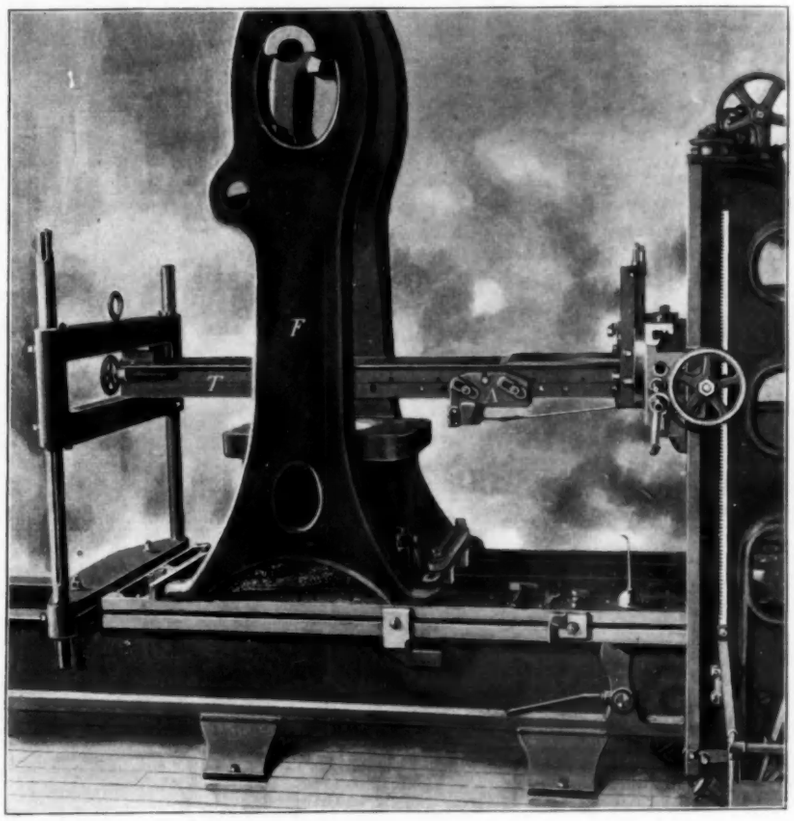
He therefore contrived a special tool with a "nose" about 8 feet long, as shown at *T* in the picture, wherein an ordinary 48″ x 48″ x 16′ Pond planer appears, and *F* shows the frame casting of a columnar power press, the bed of which is to be planed.

Obviously, a tool of this length had to be supported at the outer end, with its support so arranged that the tool might slide sidewise therein, in the same plane as the other end thereof attached to the head working upon the cross-slide. This support consists, as shown, of a base casting fitted into the V-grooves of the planer bed, and clamped thereto by a cross-bar underneath, carrying, by means of two adjustable posts made of ordinary shafting about 2½ inches in diameter, a truly slotted head casting, adjustable in hight upon the posts and fastened to them by set-screws. This head has sufficient hight of bearing on the posts that it may be kept in a horizontal position, parallel with the cross-slide, and that without "cramping." Obviously, it is cheaply constructed, as it is placed upon the base casting with the truly planed surfaces of both laid together, while two parallel holes for the posts are bored vertically through both at once.

The bar *T* must obviously have a small up and down working adjustment, say of about 1 inch, to enable the successive cuts to be made upon the work, as it would not be easy to adjust the tool slide up and down and, at the same time, to adjust the head of the support in agreement therewith. A separate adjusting block *A*, provided with a swinging tool-holder, is arranged to adjust up and down upon the bar forming the body of the tool *T*. On acount of but little hight being available (the arch-like openings of the work being sometimes very low), the vertical adjustment was obtained by sliding *A* endwise upon two studs, with inclined grooves in the block working thereon. The small endwise motion incidental to this arrangement is, as far as tool position is concerned, of no consequence, but is utilized to obtain the desired vertical motion. The block A is attached to a flat sliding bar, driven backward by a spring and pulled forward by a hand-wheel, shown at the extreme left in a convenient position for manipulation while the planer is running. This flat bar, sliding in a recess of the casting *T*, is provided with various holes, as is also the bar *T* itself, so that *A* can be placed in any desired position for large or small work.

The cutting tool itself is a piece of ¾-inch round tool-steel, inserted at a slight angle from the horizontal, and with the front end ground off to a proper bevel to give the "rake" necessary for cutting. Two holes are drilled for the insertion of this cutter, one at the right and one at the left side of the tool-holder. These holes are so drilled and the cutter so backed up that when inserted in either position it will come exactly the same hight. Moreover, having its forward end inclined outward as well as downward, it will work very close in to both corners of the opening in F. By thus changing it from one hole to the other the surface of the bed can be planed entirely over to the vertical faces of the columns which are at each side thereof. This arrangement is necessary, as it is obviously impossible for the whole tool to slide a sufficient distance sideways to cover the entire surface to be planed, its own total thickness and the clearance each side having to be deducted from the desired motion.

The adjustable gib upon the top of the bar *T* enables the latter to remain reasonably tight in its bearings, in spite of wear in the slotted support.



A MUCH EXTENDED PLANER TOOL.

The rear end of the bar *T* is widened out into a strong tee-shaped plate, running at right angles with the main body thereof, this plate being securely bolted at the right-hand and left-hand sides, respectively, to the two heads of the planer—it being fortunate enough to possess more than one of these appendages. This arrangement gave proper stability against the side thrust of the work against the tool in either direction, especially as the block carrying the cutter is generally used near the rear end, in the neighborhood of the cross-slide.

A cord equipped with a small spiral spring is shown in the rear of the cutter-holder, being used for pulling it back after being lifted by the running back of the work under the tool. Obviously, the sidewise feeding is done automatically, in the ordinary way.

Curious Centrifugal Pump.

A friend who is sojourning in Germany writes as follows:

"That you have a pretty fair knowledge of matters mechanical I have always presumed, yet I venture to doubt your really knowing how to define a centrifugal pump and the method of its driving and operation. If you longer remain in benighted ignorance it shall not be my fault, if you will but carefully read the enclosed clipping, taken from an article in the 'Paris Herald,' that purports giving full instructions on the nature and mechanism of the various types of automobile carriages.

"Do you not think it would be well for you to relieve Mr. Dolnar from his further labors, since you can can surely get more accurate and certainly more novel descriptions from an unhackneyed point of view by utilizing the above paper?"

The clipping enclosed is as follows:

"The centrifugal pump consists chiefly of a turbine worked by a flywheel.

"The turbine consists of a hollow, in which revolves a board attached to the same axle supporting the flywheel, and consequently revolves with the latter. The board is divided so as to present small helicoid wings. Their rapid rotation forces the water through a pipe up to the lower part of the refrigerant pocket."

A Broken Flywheel and How It Was Repaired.*

BY JAMES M'BRIDE, BROOKLYN, N. Y.

This wheel was one of the band wheel type, weighing between 30 and 40 tons, was driven by a pair of Corliss engines 30 inches in diameter by 60 inches stroke, and ran 53 revolutions per minute, carrying two double leather belts, one 48 inches wide and one 34 inches wide. The rim was composed of ten ribbed segments attached to the arms at the center, and bolted together at their ends between the arms, each arm carrying one segment. The construction of these segments will be understood by referring to Figs. 4 to 9, of which 5 and 7 are views of each half of the wheel spread out flat and looked at from the inside.

Four of these ribs, each 5½ inches deep by 1¼ inches thick, run around inside the rim, and are intersected at right angles by other ribs across the rim. Those at the ends of the segments making the flanges are 1½ inches thick, and those extending out from the arms are 2 inches thick.

The segments are bolted together with six 1¾-inch rough bolts in a cored hole 1⅞ inches in diameter, and through each pair of flanges there are two ⅝-inch steel dowel pins. The segments are secured to the arm flanges by four 2¼-inch bolts, and the arms are secured to the hub, each with two 2¼-inch bolts through the hub flanges.

It will be noticed by reference to Fig. 3 that there are really three wheels in the width of this broad rim (90 inches), and that only the center one, 37½ inches wide, gets any material support from the arms.

As this was the method of building broad-rim band wheels some years ago, and as there may be others who are troubled with the fear of such wheels going on a "bust," the writer, for the benefit of such, has decided to tell how he repaired this one that was badly broken. The wheel was erected early in 1885, and ran until 1889, when an accident to the governor permitted the engines to run away with it. It is not known what speed they reached, but it was found upon examination that a number of cracks had appeared in the ribs, located as shown by the crosses (x) on Figs. 4 and 7.

There were thirty-one of these cracks, and it will be noticed that they are all located around where the segment is bolted to the arms. It has been suggested that some of these cracks may be due to shrinkage of the castings, but out of more than 200 other places on the castings where such shrinkage could occur, not one is to be found, nor were there any in the castings anywhere when the wheel was erected.

It therefore seems that these cracks must have been caused by the strains on the metal when the engines ran away, by reason of that part of the rim between the arms being forced out by centrifugal force due to high velocity, as this is just what would occur under similar conditions.

Careful examination of these cracks during the last ten years did not show that they were extending, but the surface of the rim running out of true, and this untruthfulness being very much increased by increased speed of the engines at times when all the work was thrown off, it was determined to strengthen the wheel and, if possible, restore it to its true running condition.

As the wheel was in service twenty hours of the twenty-four, each six days of the week, and as business would not permit of a long stoppage, the writer devised the method here described:

Fig. 1 is a side elevation of the wheel; Fig. 2 is a cross section near where the segments are bolted together, and Fig. 3 is a cross section of the rim near the arm; Figs. 4 to 9 are flat and edge views of the rim, while the rest of the figures are details of the different parts on a larger scale. After completing the designs, it was thought best to submit them to some expert engineers in this line before proceeding with the work. Mr. Albert A. Cary, of this city, and Mr. James B. Stanwood, of Cincinnati, Ohio, both members of this society, were employed to examine and report on the case. They reported that the method submitted was the best one that could be used, and with certain modifications would make the wheel perfectly safe. Among their suggestions were the following:

1. That the bolts for bolting the rim flanges together be enlarged; that the holes in the castings be reamed, and turned bolts used.

2. That the outside steel flange plates should be made a true parabola, as shown by the heavy dotted lines on Fig. 10.

3. That the tie rods take hold farther from the edge of the plates than was shown on the design.

The latter suggestion was adopted. The

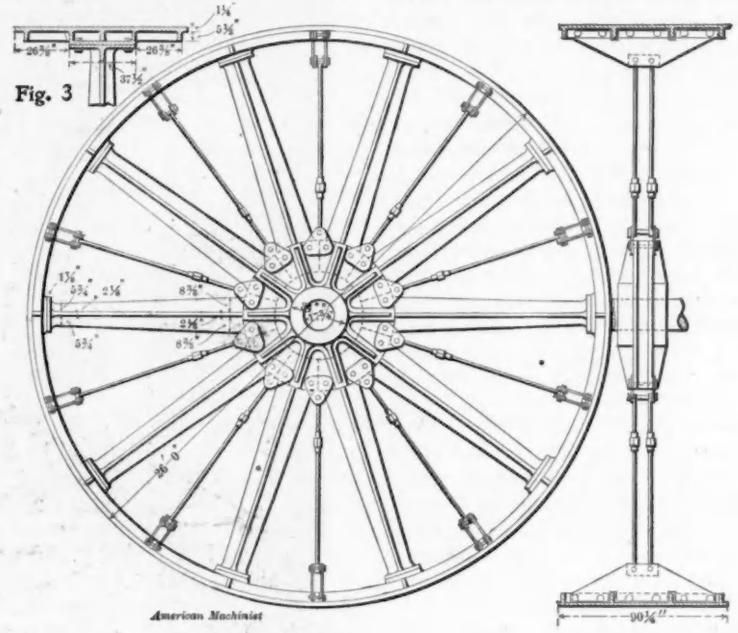


Fig. 1 Fig. 2

THE WHEEL THAT WAS REPAIRED.

*Presented at the New York meeting (December, 1899) of the American Society of Mechanical Engineers.

first one involved so much extra labor and expense, and the benefit to be gained was so small, that it was not followed; the method described and shown in Figs. 16 and 17 very nearly accomplishing the same result. The second suggestion would probably have been followed, only that it involved cutting away of much more of the engine room floor (which is iron) and the removal of the railing around the wheel; hence it was decided to use plates of the shape originally shown.

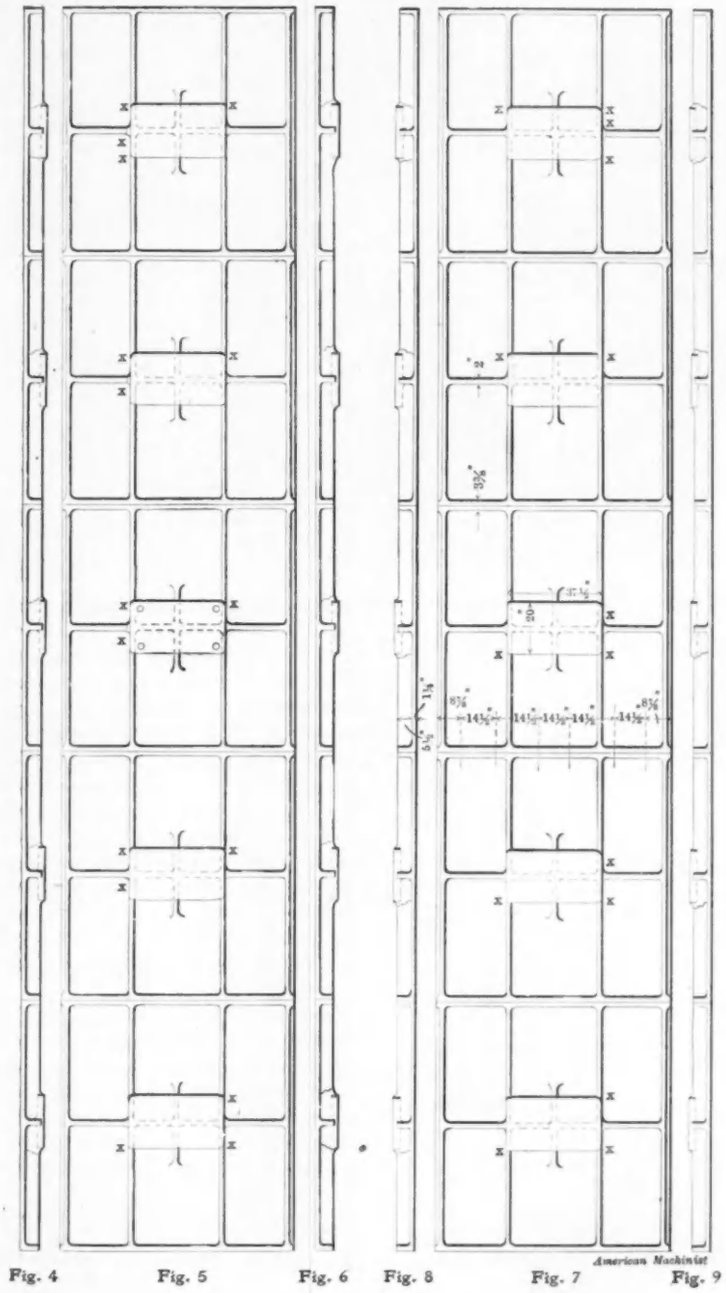


Fig. 4 Fig. 5 Fig. 6 Fig. 8 Fig. 7 Fig. 9

THE TWO HALVES OF THE RIM LAID OUT FLAT.

It was determined to fasten the segments to the hub of the wheel by means of flat steel plates ⅜ inch thick, one bolted on each side of the flange where the segments are connected, and by two iron tie rods with turn-buckles, and triangular plates fitted over the heads and nuts of the bolts, binding the arms to the hub. Figs. 10, 11 and 12 show the details of the fastenings to the hub and rim, while Figs. 13, 14 and 15 show details of fastening the tie rods to the plates. Figs. 16 and 17 show method of fastening those plates to segment flanges by rough bolts.

This last-mentioned detail was a very important one, on account of a rough bolt not fitting a rough hole, and as it was deemed impracticable to ream those holes and put in a turned bolt, the following method was employed to get a complete metal bearing on the tie rods from the hub to the rim:

The bolts were removed from the segment flange, one plate laid to its place, and the holes marked on it 1⅞ inches in diameter. The holes through the steel plate were to be only 1¾ inches in diameter, and were not drilled in the center of the marking, but so that the edge of the hole touched the side of the marking next to the center of the wheel, so that when the bolt was put in place it had a bearing on the flange next the center of the wheel and on the plates next the rim. This left no lost space to be taken up when the tie rods were tightened.

The triangular-shaped pieces (Fig. 11) were punched so that they slipped neatly over the heads and nuts of the bolts on the hub, and marked and fitted close to the sides next the shaft. These plates were fitted in pairs and held in place by a ¾-inch bolt passing through them just outside of the hub flanges. After being thus fitted and held in place, the center of the bolt holes for the ends of the tie rods were laid off by correct equal measurements from the centers of the flange bolts and from the side of the shaft.

These plates are held apart by a separator 2½ inches in diameter, with the ends turned down to take the eyes of the tie rods and plates, and are held by nuts on each end, as shown in Fig. 5.

The outer ends of the tie rods are secured to the steel plates at the rim by eyes and turned bolts, as shown in Fig. 10, the holes being reinforced on the inside of the plate by smaller plates ½ inch thick.

One plate of each pair at the rim was marked from segment flange, and its mate bolted to it and both drilled together.

To mark off this work, and to put it back in place when finished, advantage was taken of the hour four times a day when the engines were stopped; the parts on the hub being put back as they were finished, until all with the short ends of the tie rods were in place, these parts being so light and near the center of the wheel as not to throw it materially out of balance.

A different method, however, had to be adopted with the parts which were attached to the segments. These were fitted in pairs diametrically opposite on the wheel, and when ready were put in place in this order, thus always keeping the wheel in balance:

After all the parts were in place and the tie rods slightly tightened, a surface gage was placed on the floor somewhat below the center of the shaft, with the pointer touching the rim opposite the tie rods. The wheel was then turned until the end of the nearest arm came opposite the pointer; the distance between the end of the pointer and face of wheel was noted, and the wheel turned back to its first position, and the rods tightened until the noted distance appeared between the pointer and wheel. Each part opposite the tie rods was thus treated, and the wheel gone over twice, when it was found that the rim, from the center out toward the edge as far as it was supported by the

flange on the arm, ran as true as when the wheel was erected, and on the edges of the rim where the plates took hold, nearly so; while the edge of the rim out from the arms did not run true, because the cracked ribs at those points allowed the rim to spring out, and could not be brought back by the tie rods.

Nothing has been said about calculating the strength of the various parts, but they were all based on the assumption that all that part of the rim lying between any two arms was entirely broken loose from the rest of the rim, and that its centrifugal force at normal speed was held by the two tie rods. These tie rods were of dimensions to sustain this load with a factor of safety of nearly 5 to 1, and the strength of all other parts was based on this factor. The total weight added to the wheel was about 3,700 pounds, and the total cost of repairs, labor and material less than $500.

For the method of attaching the triangular plates to the hub of the wheel by fitting over the heads and nuts of the flange bolts, and for the separator for holding plates and tie rods, I am indebted to Mr. John Young, of Watts-Campbell Engine Company, of Newark, N. J.

To my foreman machinist, Mr. E. H. Thomas, I am also indebted for many valuable little kinks which have done much to further the work, and in conclusion I will say that the wheel is now stronger than when first erected; that it was not touched with the edge of a chisel nor the point of a drill, and that not a working hour of the engines was lost during the repairs.

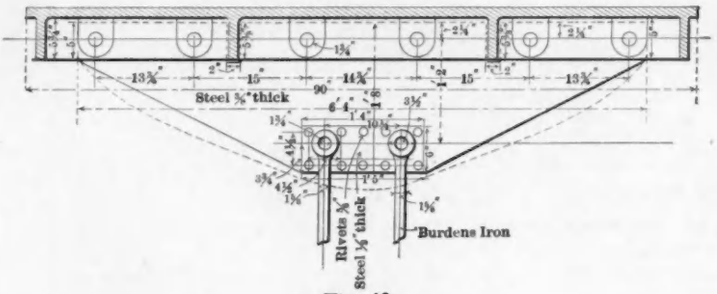


Fig. 10

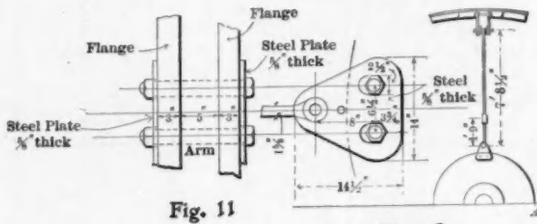


Fig. 11

Fig. 12

FASTENINGS TO HUB AND RIM.

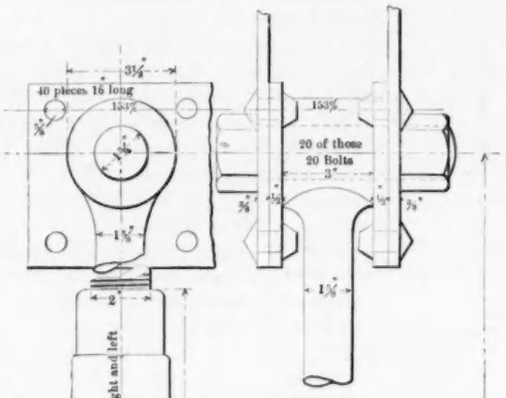


Fig. 13

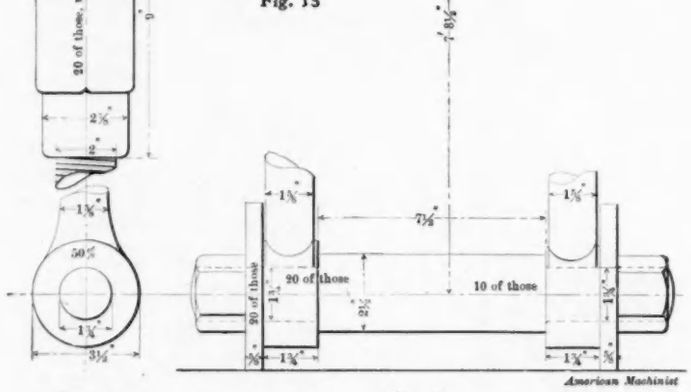


Fig. 14 Fig. 15

DETAILS OF FASTENING OF TIE RODS TO PLATES.

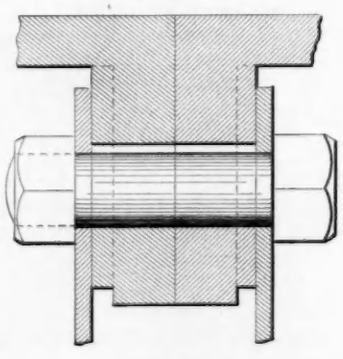


Fig. 16

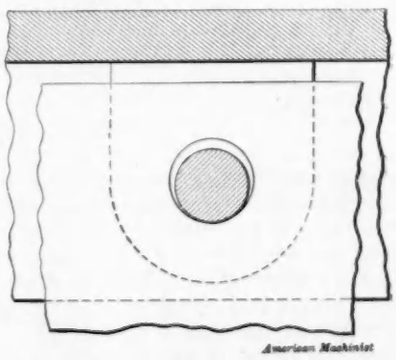


Fig. 17

FASTENING OF PLATES TO SEGMENT FLANGES.

A Kerosene Engine with Direct Connected Electric Generator.

The cheapness of the oil engine as compared with the cost of the ordinary steam engine and boiler, its self-contained independence of operation, and the low cost and ease of handling of the fuel employed, constitute effective recommendations, and it is not strange to find it so rapidly gaining in favor for small units of power. In December, 1897, we described the Mietz & Weiss oil engine, which consumes the ordinary kerosene of the stores. Since that description appeared a large number of these engines have gone into successful operation, and they have found especially satisfactory employment for isolated electric lighting plants.

The half-tone shows the latest development for this special line of service. The engine makes 400 revolutions per minute, developing 4 horse-power, and it is direct-connected to a generator standing upon the same base, and which supplies current for forty 16 candle-power incandescent

lamps. An elastic coupling of new design, and which we hope to describe later, is used to connect the shafts. The engine being of the two-cycle type, an explosion occurring and an impulse being normally

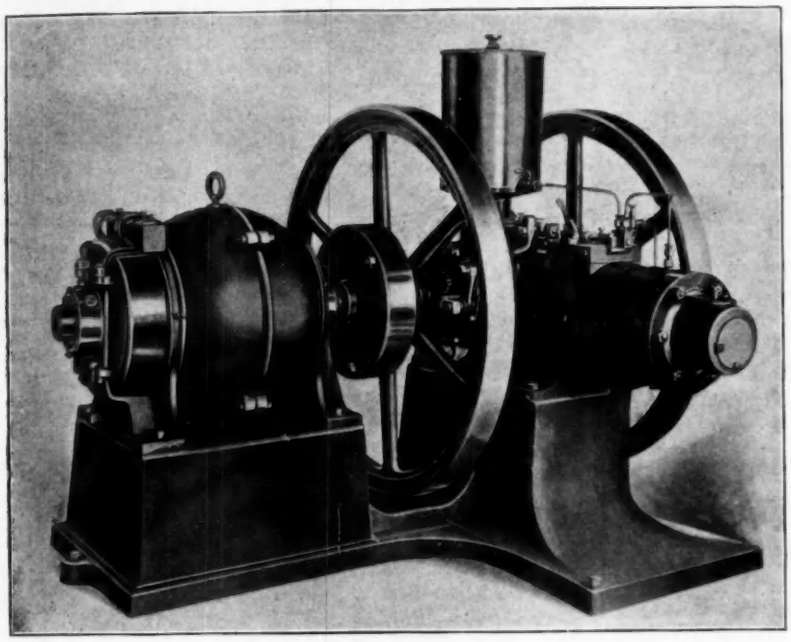


FIG. 1. THE MIETZ & WEISS OIL ENGINE WITH DIRECT-CONNECTED GENERATOR.

imparted for each revolution, renders it more susceptible of easy and close speed regulation than the four-cycle engine, and the peculiar governing device of this engine proves highly effective for the purpose. The parts of an oil engine requiring lubrication are comparatively few, but it is of the utmost importance for those to be properly attended to, especially with the high speed and the long continued runs required for electric light service. Ring oilers are used for the main bearings, as shown in Fig. 2, and the lubrication of the crank pin and the piston is taken care of by the arrangement of Fig. 3. The oil reservoir is placed at the side of the engine frame and at about the relative hight shown. At a certain portion of each revolution there is a partial vacuum in the crank chamber, and also in the cylinder, and this is sufficient to draw the necessary oil up the pipes and down past the sight holes which permit its proper regulation by the valves above. The oil for the crank drops into a groove on the top of the rod, whence it finds its way along to the pin. These automatic oiling devices, it will be noted, are only operative when the engine is running, and when the engine is stopped they require no looking after. One peculiarity of this, as of other oil engines, is that it has no throttle valve. When the engine is to be stopped it is only necessary to throw up the little finger which operates and regulates the oil admission. The engines, with or without the generators, are built by August Mietz, 128-132 Mott street and 87 Elizabeth street, New York city.

Those who are familiar with certain lines of manufacture, especially hardware, know that the castings are sometimes made with drill centers already in them; that is to say, little countersinks are made in the pattern which will reproduce in the castings, and these serve in lieu of jigs for drilling. The Diamond Clamp and Flask Company, of Richmond, Ind., are furnishing these centers made of brass and designed to be inserted in wooden or metal patterns, as the case may be. The countersinks are properly made, so that they will draw well, and at the bottom is a small center for the leg of a pair of dividers, by means of which the line of a boss may be struck after the center is inserted.

Recently published official figures show that "practically more than 99 per cent. of the whole population of Russia are constantly in a state of abject poverty and pauperism in their various degrees," and commenting upon this "The Anglo-Russian" says: "Upon the slightest improvement in the condition of the peasantry and working classes not only would all Russian manufactures and industries find a market at home, but would be far from supplying the internal demand, which probably for generations yet will be in need of assistance from abroad. So let it be once more realized that the real national interests of Russia lie not in aggressive and territorial expansion, but in internal reform and improvements, in political and religious freedom, which would make it impossible for 'one thousand' millionaires to trample upon the lives and happiness of millions of people."

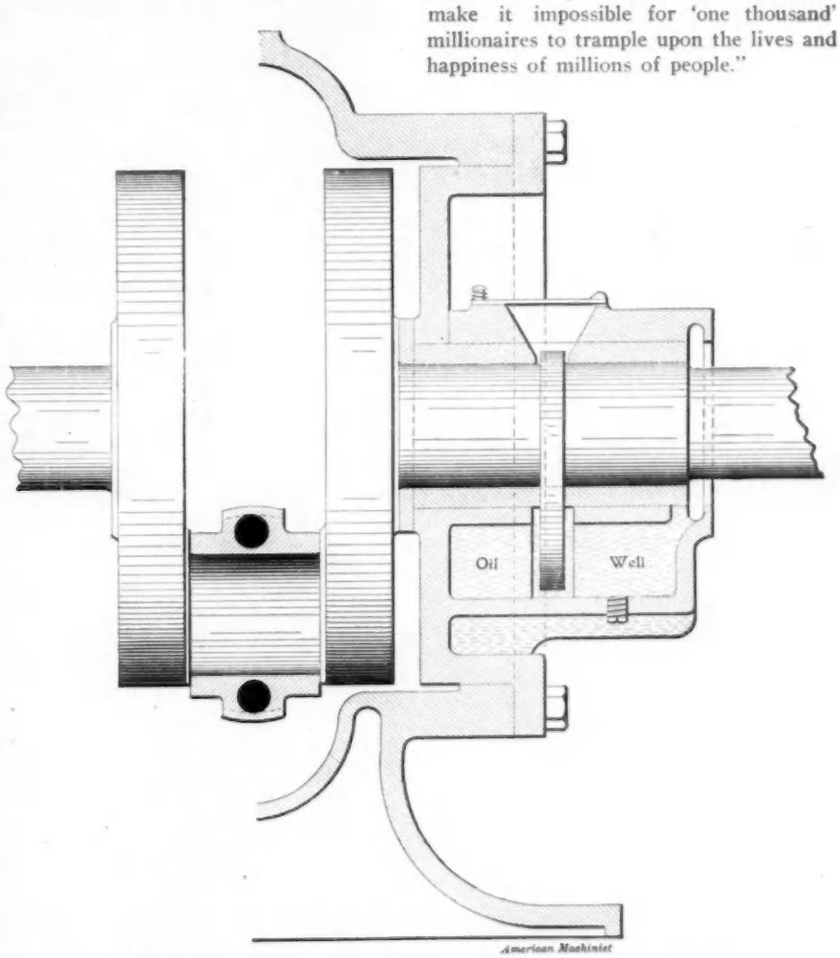


FIG. 2. SELF-OILING RING BEARING OF MEITZ & WEISS OIL ENGINE.

The United States Machinery Building at the Paris Exposition.

It must be gratifying to all our readers, at least all our American readers, to know that the machinery interests of the United States are for the first time to be adequately and creditably represented at an international exposition held outside our own territory. By the courtesy of Mr. F. E. Drake, director of the United States exhibit of machinery and electricity at the Paris Exposition of 1900, and his assistant, Mr. James T. Anthony, we are enabled to lay before our readers a brief description of the American machinery plant as finally arranged. The general machinery exhibit of the exposition is to be located in the beautiful park (Bois) of Vincennes, and the space allotted to the United States is in the shape of a triangle with sides of, approximately, 700, 800 and 900 feet, respectively, forming an area of about six acres, not including the wide drives which entirely surround it and separate it from all the other exhibits. Besides the main building will be noticed in Fig. 1 several smaller buildings for individual firms or interests and erected by the enterprise of the exhibitors. The main building and its contents will be entirely of American material and construction, except that the exterior of the building will be covered with "staff" furnished and applied by a French firm; this particular being insisted upon in order to preserve a desirable uniformity throughout the entire exposition.

The main building has been designed, manufactured and erected by the Berlin Iron Bridge Company, East Berlin, Conn., the steel being furnished by the Carnegie Steel Company, of Pittsburgh. The building consists of two sections, the principal one being 346 feet long and 77 feet wide. The central portion of this section is 33 feet wide and 32 feet 6 inches from the floor to the lower chord of the roof truss. A 30-ton electric crane travels the entire length of this section, having a clear lift of about 21 feet. The wings of this section are 22 feet, with a clear hight of 16 feet. The south section and front of the building is 277 feet long and 47 feet wide, with a clear hight of 15 feet. The floor area of the main building is thus 40,000 square feet. The engine and boiler house is in an attached building on the north side and near the west end of the main building. The power distribution throughout is to be entirely electrical, and accordingly here is installed a Ball (Erie, Pa.) 300 horse-power engine with a direct-connected 250-kilowatt Bullock generator. There are two Morin Climax boilers of 250 horse-power each. The boiler room is surrounded by a gallery. A Blake feed pump is used and a Taunton feed-water heater. The cuts give a good idea of the buildings without further description. It will be seen that there is a liberal supply of windows and also of skylights. For the latter, the new "translucent fabric" is used and "ruberoid" for the roofing.

The Organization and Management of the Drawing Office.

BY JOHN B. CROCKER.

The drawing office lies so far from the check which the customer gives for the finished product that the proprietor sometimes fails to see the connection. According to this logic the boxers and shippers ought to draw large salaries, but somehow they don't.

In any small shop engaged in building special machinery from its own new designs, the head draftsman can make or break the whole concern.

Just now there are many young men rising to responsible positions. These are the hope of the future, and as such deserve some notice; perhaps a few thoughts from an older co-worker will not come amiss.

For the sake of clearness the subject may be taken in rotation, as follows:

The chief draftsman; some of his necessary attributes and qualifications.

The selection, organization and management of the office force.

The classification and distribution of the work among the men.

The social relation to other shop departments.

Marking of drawings and patterns as regards identification and storage of both.

Listing and ordering for patterns, castings, forgings, etc.

The head draftsman should be a gentleman first, last and all the time. This does not mean silk hat, kid gloves, patent leather shoes, hair parted in the middle, late hours, and all the rest of it. This specimen of the *genus homo* is not apt to get so far up; besides the salary is not sufficient for these things.

He should be a man of clean character, clear eyed, quick of perception, firm, thoroughly honest, having sound judgment based on experience, ready to look every man and woman straight in the face and "give a reason for the faith that is in him." Thus shall he fear none, have the respect of all and the obedience of his subordinates.

You ask what has all this to do with shop cost? It has a great deal to do with it. Mean men cannot stay in his office, first, because he will not let them; second, because there will be such an *esprit du corps* among his men that a loafer or a dead beat will not be tolerated. This means a clean-cut job all round, good drawings and few mistakes.

There must be a feeling of friendship without much familiarity between the chief and his men. Some will be better than others, but he must not show partiality. Having specified a gentleman in the first place, it is hardly necessary to speak of his conduct outside the shop. An experienced proprietor once remarked to the writer: "I don't care how a man behaves outside my works, just so he attends to business during working hours." This was said in defense of his superintendent, who was at that moment losing his control over his men by misconduct outside, and has lost at least four good positions since that time from the same cause. The remark was honestly made, but it was a glaring business fallacy just the same. The fallacy consists in assuming that the work will be as well done by a rowdy as by a clean man, which, other things being equal, is never the case—not in one instance.

The head draftsman should understand the mathematics and processes of machine design, but a well-trained eye is much

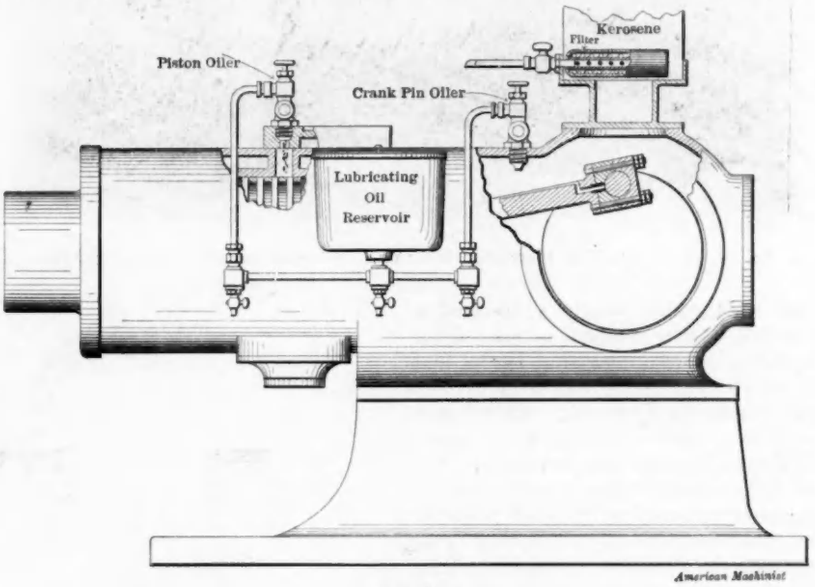


Fig. 3

AUTOMATIC OILING ARRANGEMENT FOR PISTON AND CRANK PIN.

surer and much quicker than mere figures. Calculation should check judgment and *vice versa*.

One of the best machine tool designers in the United States, now the engineer for a very large concern, is a man with good eyes and little mathematics. He knows how to calculate, but finds very little of it necessary. The young college man has a feeling closely bordering on contempt for such methods, but admiration takes its place later.

This faculty cannot be taught in schools—it is partly born and partly made. It comes from a fine sense of form and proportion, with a certain intuitive feeling that a thing is right when it looks right. This is true, granted the eye, but the educated eye is the product of experience; close observation oft repeated.

You may not be able, and generally are not, to state stresses in pounds and tons. You never know how strong a thing is till you have broken it in a testing machine; then it is too late for that piece. The other may not be like it. But a man of good judgment will know when it is about right. That's as near as anybody can come, and he will be successful. This is not an attack on technical schools; far from it; they are good, but they are not "the whole thing."

The chief should be promptly on time in the morning, with his work for the day mapped out. This will, of course, be more or less altered by the day's occurrences, but he should have the map anyhow. He must have a thorough acquaintance with shop processes and the capacity of the machine tools to handle sizes and complicated shapes. He can thus determine whether to cast things whole or bolt them together, sometimes an important item. Nor must he neglect the width and hight of railway tunnels, nor the capacity of ships. He must also know something of pattern making and molding, else he will find shop costs going up.

He should cultivate the acquaintance of the shop foremen and the skilled mechanics of all departments. He will thus learn a great deal and be in the way of getting much needed help, preventing many serious mistakes of himself and others, also preventing mistakes from becoming serious, which is the next best thing, for they will happen sometimes.

Last year the writer visited a shop in Berlin, where he was informd that designs were first fully drawn and then sent to the shop foreman to find out whether they

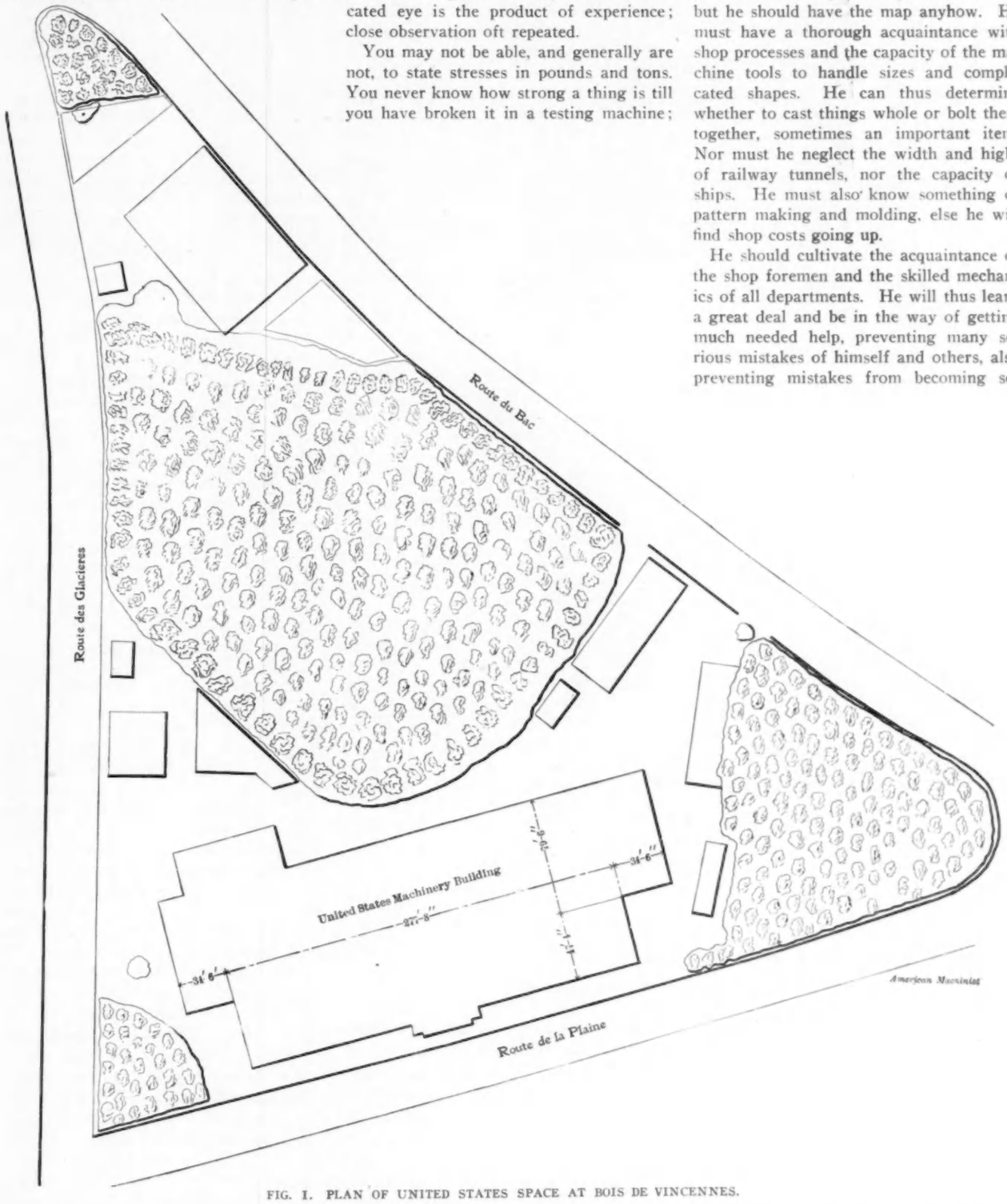


FIG. I. PLAN OF UNITED STATES SPACE AT BOIS DE VINCENNES.

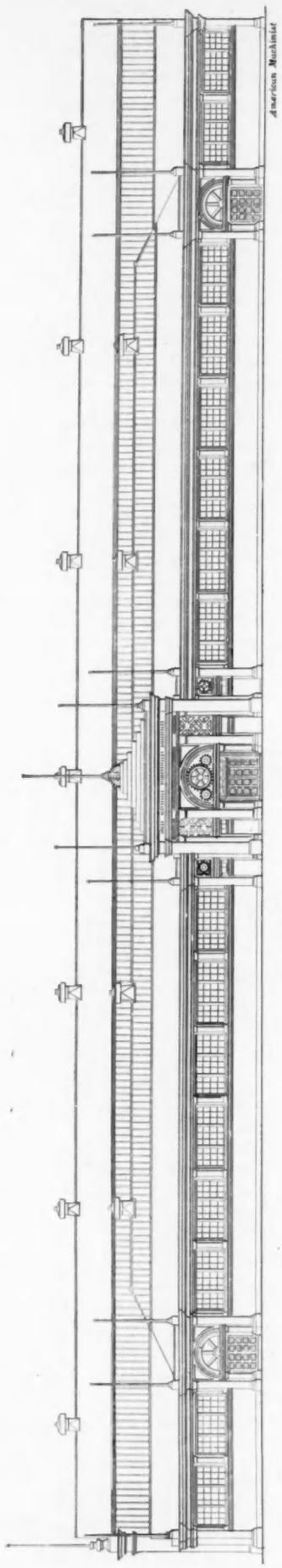


Fig. 2
SOUTH ELEVATION OR PRINCIPAL FRONT.

could be worked or not. It was not considered the duty of the drawing office to know this beforehand.

Another shop has been heard of nearer home where the machine department is compelled to take care of anything the office may see fit to send in, no effort having been made to find out whether the tools could handle the work or not.

All departments must work in unison. Their interests are identical, namely, to turn out the largest possible product at the least possible cost, quality considered. We may work for wages, we may not have any share in the product of extra effort, but wages should not be in our minds while we work. The question of wages may be discussed with the proper person at the proper time. Work for good work's sake, then get all you can for it by honorable means. The proprietor who screws wages down to the last possible limit deserves to have only men who do as little as they can to still hold their jobs.

In selecting men for the drawing office force, the chief draftsman should have the final decision. He is responsible for his department. He knows what he needs much better than anyone else can know, otherwise he is unfit for his position. It is subversive of all respect and discipline to have a man come into the office, stand around until patience is exhausted, then when the chief asks his business, he finds that the superintendent has hired a new man who is now waiting for a job.

Men who have no aptitude for ready perception and origination should not be retained in the drawing office. Dullness is expensive; it is a drain on brain and capital. Men who cannot originate can never learn to design. Young men should never aspire to a position in the office to remain mere copyists; it doesn't pay. They should be protected from themselves when imbued with such notions.

Middle-aged men may be chosen for what they are, and retained accordingly—young men for what they are likely to become, and treated accordingly.

The fond father brings his boy, with the assertion that he can draw anything—thinks he will make the finest draftsman in town. You find he can sketch cats and dogs, but doesn't know a monkey-wrench from a twist-drill. He ought to go in the shop and then to a technical school, if he shows enough aptitude to warrant it; but family relationships prevail. He comes into the office. He is paid per week $3 wages and $10 worth of the chief's time, while hurry jobs wait on rudimentary instruction. You cannot afford to run a kindergarten in the engineering department, no matter if the proprietor does wish it.

Courtesy toward employees is worth much and costs little. A man is a man. Personal abuse on account of a miswritten figure is entirely out of place. That element may be left out of a reprimand and still have it severe enough. If a man be found constitutionally inaccurate he must be set to rolling a wheelbarrow or reporting for the political papers, where accuracy is not paid for, nor wanted.

Night frolics and late hours are fatal to accuracy; a big brain may go, but not a swelled head. Engineering requires brains and years of experience, mere copying neither.

The comfort of the men should be carefully looked after. Plenty of soft, white light; plenty of fresh air, without draughts; conveniently adjustable tables, with parallel straight-edges, and not T-squares, are conducive to accuracy and large output. A man cannot be expected to think, breathe foul air and break his back all at once, nine hours per day. You may pay the man $15 per week, but some other fellow will be to pay when the erecting gang gets the finished pieces.

The work of the drawing office may be roughly divided into three kinds—new designs, changes in standard machines to suit customers' orders and revision of standard work to keep it up to date. Besides these there may also be attachments to make, jigs and templates to lay out, sometimes new buildings to plan, and numerous other things, which no one would ever think of beforehand.

For new work and modified orders great care is required in looking up all correspondence, for the order is rarely explicit. Something hidden away on the offside of a two-months-old letter may play the mischief with the collector and bank account. The customer and the chief draftsman may be the only mechanics on the mail route; if so, the chief must have access to all the correspondence, else he can't be responsible for results.

A mechanical man ought to have charge of the above matter and be required to send a typewritten abstract to the office at once on reception of order. All orders affecting details of work must be in writing; verbal instructions must never supersede these. A first impression through the eye is likely to remain in the memory and be carried out in the work, while a conversation may be forgotten.

All important points of construction should also be given to the men in writing, with such verbal explanations as may be necessary. The men should be asked to keep these memoranda on file until the work has been accepted by the customer. This practice will tend to exactness and fair dealing all round. When a man has full instructions at the beginning of a job he can go about it intelligently; he becomes saturated with it; his thinking takes in the adjacent and modified parts; his mind is clear as to the reasons for each step. A man can never do himself or his employer justice if his work be given piecemeal; it is very discouraging.

New designs should be put in the hands of experienced men, who are accustomed

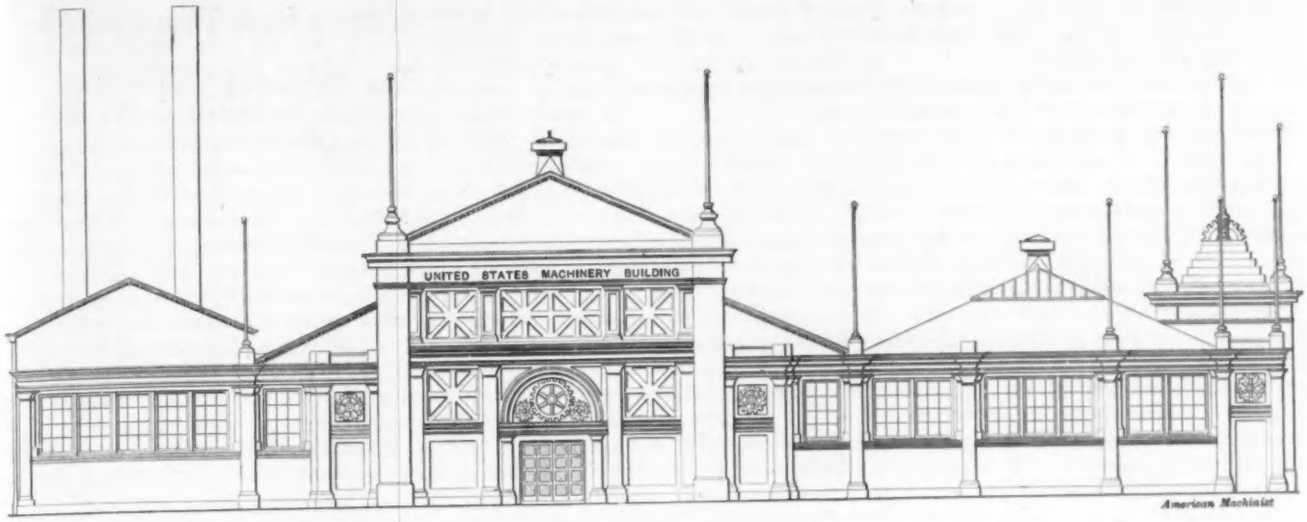


Fig. 3

WEST ELEVATION.

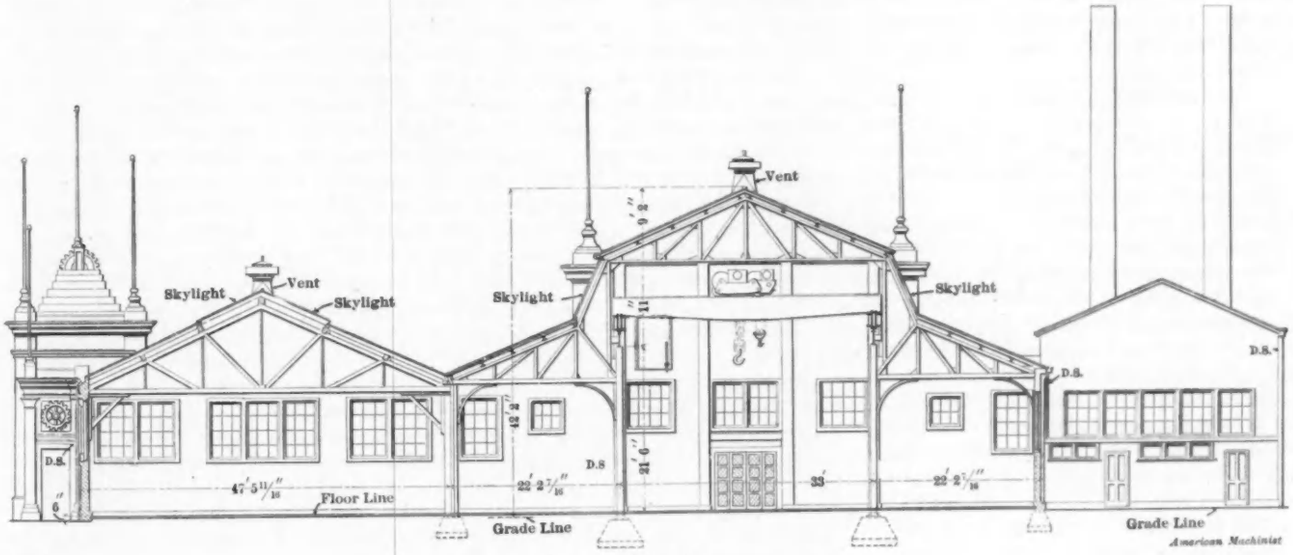


Fig. 4

TRANSVERSE SECTION.

to the traditions and methods of the shop; otherwise many incongruities in style and general appearance are likely to arise. It takes too much of the chief's time to look after every little detail. It is best to train new men for a while on attachments, shop fixtures, etc., until they get acquainted.

Radical changes on existing designs should also be handled by experienced men, else many mistakes are likely to arise in fitting the new to the old. This requires close attention and a thorough knowledge of the construction. The difficulties in this respect seem to be greater, for some reason, than in entirely new work. Orders requiring changes are apt to call for quick deliveries, like standard work, hence these jobs are generally in a hurry.

Revision is a matter that can take a little more time. It should be worked in

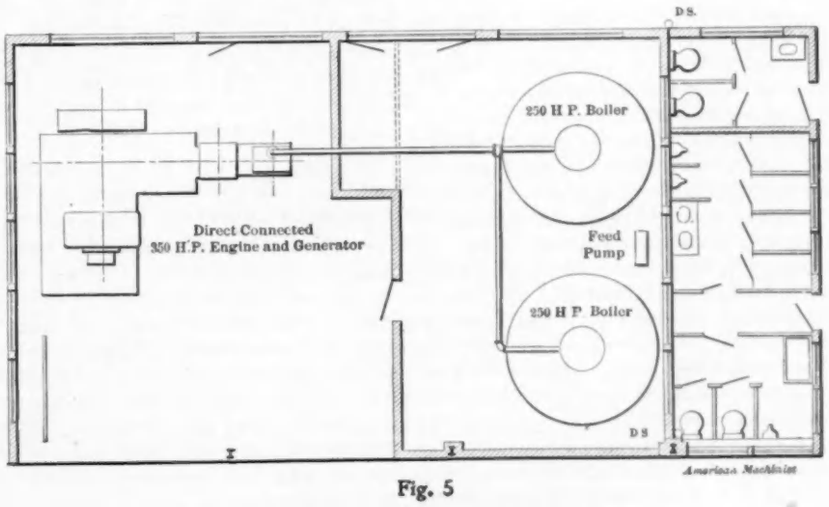


Fig. 5

PLAN OF ENGINE AND BOILER INSTALLATION.

during intervals between the rushes, if there are any. The difficulties are much the same as those last named.

The younger men in the office may be placed under the charge of the older in such groups as the exigencies of the work may require. They should be changed about from time to time. They are useful in detailing, and can thus receive much instruction to which they are entitled, but which the chief cannot take time to give. Every man should, as a rule, be given the best work he can do, otherwise expensive men will be kept on simple and cheap work.

There is no way to entirely prevent monotony and drudgery, but it can be greatly alleviated by changing around. This is very important, because it keeps the mental faculties alert and ready for action. It also has a large educational value in training the mind to concentrate itself fully on one subject and then change at once to another without loss of power. No man can be a successful head draftsman unless he possess this faculty. It is well to have some knowledge of psychology, even if we don't know it by that name.

Two methods of checking up work for accuracy as to sizes and fits have been followed. Some advocate setting apart an experienced man, who has not been engaged with any details of the job, and who must, for that reason, examine minutely every piece; he is to go over every figure from start to finish before any drawings are blue-printed. On the surface this method appears to be nearly perfect, and if unlimited time were at our disposal it would work. But, in fact, it has some inherent faults. The man who has charge of the design and details will say to himself, "I'll be pretty careful with this, but if I should happen to make an oversight the checker will find it; he is responsible." This is human nature, and no power on earth can prevent it.

Checking up drawings day after day is a most wearisome job, and for that reason is not necessarily accurate.

A good method is to put this duty on the man who designs and superintends the details. He will be thoroughly familiar with all the pieces and will probably detect an error at sight, without a reference to the mating piece; though, of course, he should not trust his memory entirely for the correction. Careful attention must be given to any changes that may have been made during the detailing; these are liable to be forgotten. This plan enables the drawings to go out as they are made, so the machine shop may be started on the work before the drawings are all finished. This makes the closest possible connection between the date of the order and that of shipment.

The above is a sort of "gang boss" system, but with good men it runs with very little friction, and gives material for emergencies, when the old chief gets sick or dies. These same men become very useful assistants in following the drawings through the various stages of construction. They thus become familiar with the shop's point of view in regard to ease of handling and erecting work. This, in turn, tends to form a strong bond of union and respect between the shop and the office. The writer has paid some attention to this feature and is sure it is worthy of consideration. It will be seen from the above that his plan is to keep his good men and make them permanent fixtures. Why not?

It seems rather in accord with the evil tendencies of human nature to allow a breach to widen between the fellow with the "boiled shirt" and the one with overalls on, but it is an expensive luxury, and a little good sense ought to show its utter absurdity. The man with soiled, horny hands is often as true a gentleman as the general manager, and sometimes more so.

The pattern shop and foundry foremen should be called in occasionally and given an advance interest by consultation. Many valuable points may be gained in this way. When differences of opinion arise, as they surely will, they can be settled by friends, instead of becoming a perpetual source of cavil between enemies.

If this plan be adopted and pursued with some tact it will foster a fraternal feeling throughout all departments, and make work a pleasure instead of a burden. That everlasting bigotry, envy, jealousy, pulling and sawing at each other, so unpleasant and so disastrous to economical management need have no place. When bad feeling is once stirred up, it would pay to discharge all participants and start afresh. One never can tell who is to blame in particular. If the worst one be discharged, the rest will be convinced that they were right; then trouble will begin with the next new man.

Perhaps the reader will have concluded ere this that the head draftsman's work is all being done by others, but he will have enough left for two men. The best management is that which turns out the best work and runs the smoothest. The most valuable man is not he who can do the most, but he who can get the most done by others.

We have received from "The Ironmonger," 42 Cannon street, London, England, a pamphlet containing articles reprinted from its columns, and which articles are devoted to an explanation of the condition of the hardware trade in Canada. These articles purport to tell why it is that, in general, British hardware manufacturers are not holding their own in the Canadian markets, and as these reasons and the conditions are very frankly stated the articles ought to make interesting reading for those who are interested in hardware here, as well as in Great Britain. The pamphlet is sold for one shilling.

Letters from Practical Men

The Mechanical Adaptability of Liquids for Operating Machines.

Editor American Machinst:

I sometimes take a minute or two, or the time takes itself, to ask the question, What is the idea most prominent and most actively revolved in the mind of the mechanical world at that particular moment? What is there novel and striking and abundantly profitable that our inventors and designers are just now planning to do, or, rather, what novel means or arrangements are they purposing to employ?

I have an idea that the most interesting thing to consider, and the most profitable to follow just now, is the operating of machines, or, more particularly, the details of their mechanism, by the pressure of liquids. I have various hints that a lot of fellows are thinking about this, and some of them are busy in drafting rooms over it, while others have gone further still, with most cheering results. The "Patent Office Gazette," which I have just as much right to look over as any other fellow, gives the thing away, so that I am betraying no confidences. There are many things that are now done by racks and pinions, by screws and worms, by cams and levers and wedges and toggle joints, and by all the familiar mechanical movements, that might be better done, and which are going to be better done by liquid pressure. Some more of our "mechanical" devices are in the progress of events to become "unmechanical," because they will be demonstrated to be mechanically unprofitable.

Take a planer, for instance. We have lots of rack and pinion planers, and worm or screw driven planers. I ran for two or three years in the late fifties a chain-driven planer, which was as simple and about as effective as any of them, only the chain would wear out pretty fast. The best of our planers even yet is not without its objectionable, or at least unsatisfactory features. The quick return stroke has had lots of tinkering and discussion. And when we have done all we can for the quick return there is still trouble about the cutting speeds for different metals. If you have your planer speeded for cutting hard steel, you may still employ your quickest return speed. But if you want to speed up your machine for brass, where will your quick return be then? So far as I know, we have nowhere obtained for our planer movements precisely what we want, but only just a respectable compromise.

Now suppose that we should take from the planer all our pulleys and shafts and gears and racks, and just move the platen back and forth by means of pistons working in hydraulic cylinders; how perfect and how perfectly controllable a movement it would be possible to secure. I

need not go here into any of the details of the arrangement. We have to assume only an adequate supply of water or other liquid, and the means of maintaining the necessary pressure. There might be either two single-acting cylinders or one double-acting cylinder. You open a little valve and the platen moves along slowly for its cutting stroke, the speed of the movement being dependent upon the valve opening. There would be two valves of admission, through both of which all the liquid would have to pass, one of the valves being adjustable according to the cutting speed requirements, while the other would be simply an open and shut valve with a larger opening to let the current on or off. The stroke of the platen would be adjustable by dogs in the usual way, and when the end of the stroke was reached the dog would trip a lever which would close the admission valve, open a larger discharge valve, close the discharge valve for the return stroke piston and open the admission valve for the return stroke; these four valves being all mechanically connected and moving at once. When the end of the return stroke was reached, the other dog would move all the valves in the reverse direction, and this would keep the platen moving. A throttle valve would stop and start the machine. There would naturally be two admission valves, one of them adjustable, for the return movement, but it would not generally be necessary to change this adjustment. The quickest practicable movement for the return being secured, that would remain unaffected by changes of admission for the different cutting speeds.

The liquid pressure is, of course, applicable to the operating of shapers, slotting machines, and all other tools which have reciprocating movements, and adapts itself more neatly to such machines on account of the shorter strokes employed. It may be objected that it is not practicable to use the hydraulic pressure except for slow movements, and that it is only applicable to rams and presses and cranes and such things. This can't be so, as we run pumps at a considerably higher speed than that of a planer or a shaper, and there is no apparent reason why the water may not be run at one end of the series nearly as lively as at the other.

But the liquid pressure especially commends itself to our consideration for operating the feeds and auxiliary movements on our various machines. Here it is not confined to reciprocating machines, but is practically universally applicable. Water under pressure may be made to impart movement as slow or as fast as may be desired and in any direction as well as in any other. It gives positive movement without back-lash or lost motion, and the rate of motion imparted may be increased or diminished as required. It would seem to be the ideal agency for nearly all machinery feeds, and it should be capable of greatly simplifying the construction and operation of most of our tools. If it is not so employed the burden of defense would seem to be upon those who do not use it.

As far as I have gone here we seem to require a pump and a pressure reservoir, a tank for the return water, and various pipes and valves for each machine to be operated, which makes it seem more complicated and costly than necessary. It is not going far out of the way to assume for the not distant future an automatic duplex pump and an accumulator in one corner of the shop that will supply water and pressure wherever needed throughout the works.

When we do get the thing running in good shape it will not be impossible for the college boys to come along and make tests and show that our system is not economical of power, and if it amuses them and keeps them out of mischief no harm will be done. If we do waste a little power, it is really the cheapest thing there is around a machine shop, and we can afford it. There may be, however, two sides to the story about the waste of power in this service. Of course, it may always be said in hydraulic power transmission that whatever water is used is chargeable with the full pressure of the service, and with whatever power may be required to produce and maintain that pressure, while the actual service done may not call for one-quarter of that pressure. In the case of a planer, for instance, it would consume as much water, and therefore as much power, for the return stroke as for the cutting stroke. This would be so if a double-acting cylinder was used, or two cylinders of equal diameter, but a smaller cylinder could be employed for the return stroke, with a proportional saving of water and power, and there would in any case be much less power required for the act of reversing, in either direction, than when the high-speed pulleys and gearing had to be stopped and reversed so continually.

All that I set out to say in this letter was that this is a subject that is well worth thinking about, that many are now thinking about it, and that we shall be hearing of important results accomplished in this direction before long.

TECUMSEH SWIFT.

Parallel Motion Drawing Squares.

Editor American Machinist:

An article on page 31 of November 16 "American Machinist" describes one of the very useful forms of the apparatus designated in the title—mentioning that it is not new, but not referring to its origin.

It may interest the readers of these lines to be referred to pages 224 to 232 of Volume 6 of the "Transactions of the American Society of Mechanical Engineers," wherein Mr. Theodore Bergner, the patentee of this form of drawing board, describes the device in detail, with various modifications, in the year 1884.

It will be noticed that the writer, in discussing Mr. Bergner's paper, related how he had himself reinvented and used this same device, not knowing that Mr. Bergner had anticipated him by several years. Such, however, was the melancholy fact—another illustration of the frequent repetitions occurring in the conception of new inventions.

The writer's experience with this drawing board has, for nearly twenty years, been very satisfactory, but for the "cord" he has found it best to use small piano wire, about .020 inch in diameter, running upon 2-inch sheaves. This wire, while elastic enough not to bend permanently, can be stretched tighter than the twine used by Mr. Bergner and others, and will move the blade of the square without the quite perceptible stretching that occurs in the use of twine.

If he were making more of these drawing boards he would certainly use the wire cord, but would increase the size of the sheaves, say, by some 50 per cent., thus making them run more easily.

OBERLIN SMITH.

Facing Large Elbows in the Lathe.

Editor American Machinist:

Concerning the facing of large elbows, as described in your issue of November 16, I think there was considerable loss of money and time by the plan adopted. If I were to figure on that job I would use the ordinary 54-inch lathe and elevate the headstock to about the hight shown by Mr. Brown, although this hight would not have to be so precise as in his operation. Then I would bolt the facing head directly to the face-plate of the lathe, securely attaching it squarely upon the same. Then bolting the ell directly to the lathe bed and attaching the pin for feeding the tool, to the bed also, we are ready for facing.

With this rig there is considerable less time required, and no extra cost for patterns other than the piece required to elevate headstock; the driving cones need not be removed or altered, and in time would be required to attach to the planer bed. The facing head could be attached so as to give enough feed to the tool for the flanges. This arangement would certainly execute the job as well as with the bar, and in a great deal less time; consequently, more money in the job for the boss. In this manner any size of ell might be faced off with equal rapidity; in fact, this device would face off almost anything that could be attached to the lathe bed.

Possibly Mr. Brown could improve upon his original plan if he had to repeat the operation, and as I have often altered my shop operations after the first time of doing a job, this may be of assistance in future tight places for him.

Chicago, Ill. T. C. KENNEDY.

A Box Tool for Pivots.

Editor American Machinist:

The accompanying drawings illustrate a box tool for making clock pivots, corner posts, or anything of that class in which accuracy between shoulders is required.

A is the body of the tool, with shank to fit turret; *B* is a circular tool recessed at *x* to a width corresponding to distance required between shoulders. *B* is pivoted in block *C* by bolt *D*, which has left-hand thread and holes at right angles in head to receive pin *F*. Block *C* has cross adjustment to regulate diameter of pinion ends.

E is a bushing to support stock while being cut, and is cut away as shown, to clear *B*.

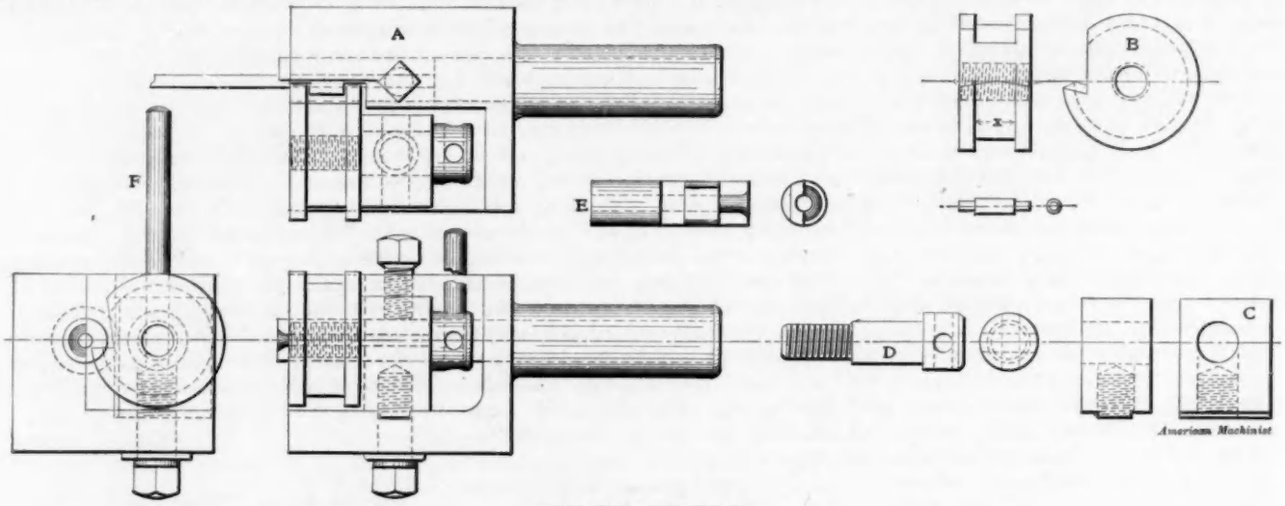
To operate, the tool is brought forward to the stop with the right hand, as is usual in screw machine work, and cutting edge of tool *B* is forced against the stock by pressure of left hand on pin *F*, which is continued until the cutter swings by. It is then turned back to clear the stock and withdrawn from the work, which is then ready for the cutting-off tool.

The diameter of the pinion ends will vary if the stock is not of a uniform diameter, but this may be avoided by selecting the stock with a micrometer.

The distance between shoulders cannot vary, and removing the tool and grinding it does not necessitate readjusting.

The stock, running in the bushing, while being cut, prevents burs forming on the corner of the shoulders, and the body and ends must be concentric, which is important on some work.

With this method, if the stock is not round the pinion ends will be out of round also, but as cold-drawn stock runs within one-half a thousandth the error will be within reasonable limits. A. J. Strong.



A BOX TOOL FOR PIVOTS.

Planing by Addition and Subtraction

Editor American Machinist:

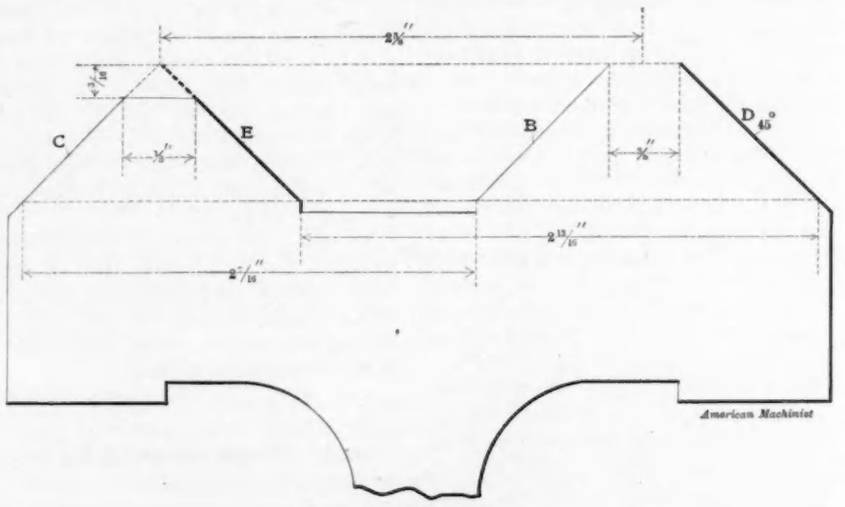
There are some things we cannot see when going through other shops, and I think I am giving one in the sketch below.

The sketch gives an end view of an 18-inch R. K. Le Blond lathe bed which shows the carriage Vs are made 3-16 above the tailstock Vs, so as to give the carriage Vs more bearing, and to also make the carriage heavier over the inside Vs. The center of one V to the center of the other is 2⅝ inches; the angle is 45 degrees; the top of Vs is ⅜ flat before being rounded off.

The planer hand wanted to plane down the angles with the head thrown over, starting with a cut down *B*, then run the tool up and move it over the proper distance to catch the cut down *C*. If the Vs were the same hight, he would just have to move the tool over the 2⅝ inches, but the one V being 3-16 inch lower than the first, and the angle being 45 degrees, caused the distance to be 3-16 less, or a move of 2 7-16 inches, to bring the tool right for the cut down *C*.

What puzzled the planer hand for a little while was, that as *B* and *C* were just the same distance from each other as *E* and *D* were, why would not a move of 2 7-16 inches bring the tool right when moving over from a cut down *D* to go down E. It may be seen with a little study that 3-16 had to be subtracted going down one side of angle and added going down the other; or, to be more plain, it was 2 7-16 from *B* to *C* and 2 13-16 from *D* to *E*. That no reflection may be cast on the planer hand, I would like to add that he is one of those fellows that won't let himself be outdone or beaten, and he has had some very good ones put against him. H. L. Cameron.

Cincinnati, O.



PLANING LATHE SHEARS.

Computing Gears for Screw Cutting.

Editor American Machinist:

I want to add one idea to Mr. J. Jay Dunn's article, "Computing Gears for Screw Cutting," in your issue of November 16. It should be noted that all the factors contained in the number of threads you wish to cut must be contained in the gears of the lead screw, that is the driven gears. If you wish to cut 5, or any multiple of 5 threads to the inch, the gear on the lead screw must be some multiple of 5. If you want to cut 6½, 13 or 26, you must have some multiple of 13. Very few lathes will cut 17, 19, 23, 29, etc., because the gears do not contain these prime factors. When the beginner desires to cut

an odd thread let him first see if the factors can be found in the gears; if not, he need not waste time in trying. It cannot be done by compounding, or any other means. W. A. BRIGHT.

Good and Bad Practice in Steam Heating.

Editor American Machinist:

The custom of heating buildings with exhaust steam from one or more engines is very common, and while it is an economical plan in nearly every case that can be found, there is still much discussion indulged in concerning the advisability of it where it causes much back pressure on the piston of the engine, but just where the loss comes in is not made plain even by those who argue that it does not pay under these conditions. Where an engine is heavily loaded there may be a reasonable objection to adding more load, because it will interfere with the speed of the machinery and so reduce the output of the works; but where the additional back pressure put on does not affect the speed of the engine, and where all of the exhaust steam delivered to the system can be utilized in heating the rooms, it certainly is absurd to claim that the additional load is lost work, for it is not.

Some engineers will take the extra back pressure, which may amount to 10 pounds, multiply it by the horse-power constant of the engine, estimate the cost of the power developed, and on this basis charge the heating account with an amount that does not belong to it. There are very few places in which the exhaust steam is just sufficient to keep the heating system filled, therefore it becomes necessary to take live steam to make up the deficiency; so that if the back pressure caused by heating calls for a longer point of cut-off in the cylinder, this steam is not wasted, for it goes into the pipes in the several rooms, and keeps them warm.

It is even claimed by some engineers, who say they have tried it, that to maintain a certain pressure in a heating system using live steam calls for more coal than to do the same with exhaust steam; but the temperature of the live steam for a given pressure may be greater than when exhaust is used, because passing it through a reducing valve on its way from the boiler superheats it.

I do not believe it profitable to carry any more pressure on a heating system than is absolutely necessary to fill the pipes and keep them full, for there must be drips of some kind or description on it, and while they are intended to remove the water only, or perhaps the accumulated air, it is very difficult to adjust every part so that no steam will escape. In one case that I well remember, a standard trap was installed to keep the system in a silk mill free of water. When the pressure barely exceeded that of the atmosphere only water was discharged by this trap, but when it was increased to 5 pounds much steam was discharged, and even the water was warmer than when a light pressure was on. People who are interested in the sale of traps will at once conclude that their own devices would do much better service, and I do not dispute such claims, for I know nothing about them; but I am sure that such traps as I have mentioned are used in hundreds of places, and render service equal to what I have described; therefore the best plan is to keep the pressure down to the lowest possible point.

In one place that I had charge of for more than five years, the exhaust pipe was continued full size throughout the entire shop. It was thick cast-iron pipe, and consequently did not warm up readily; but, on the other hand, it was slow to cool off after once well heated, so that the latter offset the former. But such an arrangement does not give the best results from the steam used, as it is better to divide it in smaller pipes. This plant is a very old one, for none of its kind has been erected for many years, so far as I am informed.

In some plants, even where coal is not cheap, the antiquated plan of having the drips discharge into an open tank is still in use, although steam is rising from it continually while in operation, thus showing that there is a constant loss of heat, which might easily be saved if a closed tank was used and the water returned to the boilers without being relieved from pressure. In others the water of condensation is allowed to go to the sewer, thus not only wasting heat but also water that has been freed from scale-making impurities. This is a great mistake, and shows that there is still a chance for the man who can introduce steam-saving devices, to get in his work. A good feed water heater may be in use in such a place; but as the cold water taken from the city supply is pumped through it, much of the exhaust steam is condensed, and this might have gone to heat the building, if the hot water of condensation had been used to feed the boilers instead of the sewer. This shows that the temperature of the feed is but one of several conditions to be taken into consideration when studying the economy of operating a steam-heating plant.

W. H. WAKEMAN.

Hinge Dies.

Editor American Machinist:

In the "American Machinist," February 23, 1899, I gave a description of a set of dies for piercing, blanking and forming small hinges or butts, where the joint is produced on one side only of the wing or plate. The accompanying sketches represent two punches and dies for forming hinges where the joint is in line with the center of the wing and stands out equally on both sides.

The material, if not too long, can be pierced and blanked out in a simple combination die as shown in Fig. 1 of the "American Machinist" for February 23, and here reproduced. However, should the work be too large, a die will have to be constructed whereby the work can be so placed in the die that the ends can be

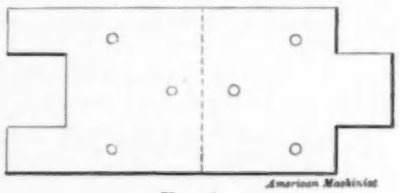


Fig. 1

BLANK FOR TWO HALVES OF A HINGE.

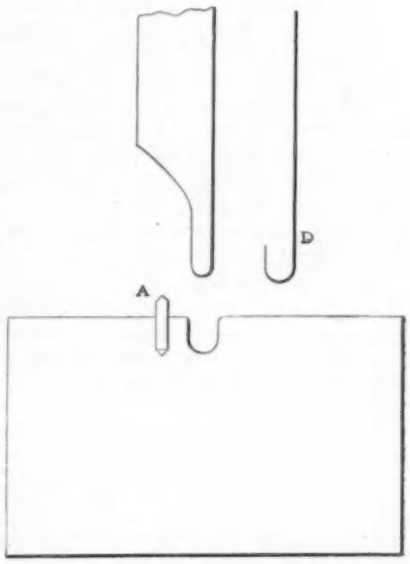


Fig. 2

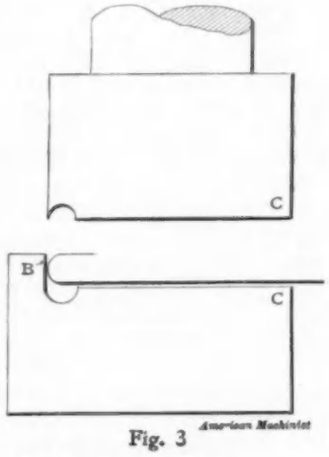


Fig. 3

HINGE-FORMING DIES.

cut out separately. With a little experience in the planning of blanking dies, the tool maker can easily make a die that will be suitable for the conditions.

The method of piercing and blanking out the two parts and afterwards separating them in a parting die, is productive of the best results; as by this plan there is practically no waste of material except the

two ends of the strip. The tongue that is punched out of one end of the strip leaves a slot in the remaining end, so that when the two parts are rolled up, if the stock does not spread out in the process of forming, they will fit exactly into each other. Thin brass will generally do this, and, even at the most, a slight touch of the file in the assembling will cause them to fit to a nicety.

Fig. 1 represents a punch and die for first bending the piece to the form shown at *D*. The work is laid on the die horizontally and brings up against the stop pin *A*, and as the punch descends the piece is bent up vertically, the long end standing against the side of the punch, which is offset for this purpose; gages (not shown) should be put on the die to guide the work sideways.

Fig. 3 shows the die and the work in position for the last operation in forming the hinge. The work is brought up against the end of the die at *B*, and is held in position by a small arbor in the hand of the operator. Usually a piece of drill rod with a handle on the end answers very well for this purpose, the rod being of the same diameter as the pin of the hinge. It is well in this, as in the previous die, to put on the gages to guide the piece sideways. When the punch, Fig. 4, descends the piece is forced down into the hollow in the die and is formed into the desired shape.

If the hinge is not too long it is well to make the punch and die of sufficient length to take in all of the wing, as it will flatten out any imperfections in the stock when the punch comes down. Should the work be longer than the punch and die, it will be necessary to round the corners a trifle at *C*, Figs. 3 and 4, to prevent the marking of the work.

The width of the dies should be made in proportion to the size of the hinges. The dies can be used either in a power press or a drop-hammer. The punch and die, Fig. 1, for long hinges will generally have to be used in the latter. The forming punches and dies answer for both male and female parts.

While there are several methods for making dies for hinges of this style, those shown in the above sketches are the cheapest that we have been able to use with entire satisfaction. DIE MAKER.

Lynn, Mass.

A Handy Boring Tool.

Editor American Machinist:

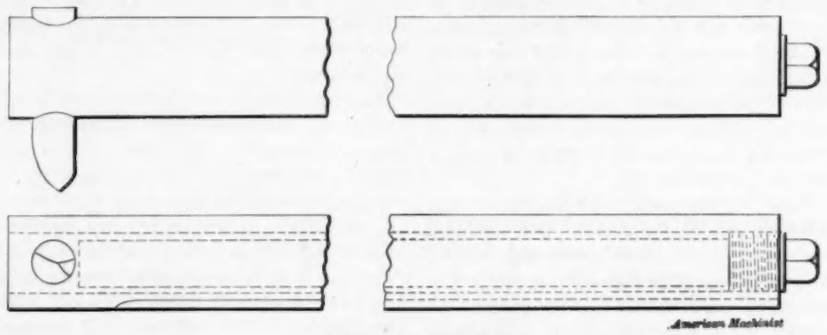
In your issue of October 19 I notice a boring tool described as original by Mr. A. F. Horton. I have made and used for a number of years just such a tool, except that I used mine for much larger work, and instead of using a solid bar mine is made of extra heavy steel tube. I send a sketch of the tool, which is used in a standard with two uprights and a base like Mr. Horton's. The cutting tools are of 5/8-inch round, self-hardening steel. My mode of fastening the tool is to run a small bar through the center, one end of the bar bearing against the middle of the round tool and the other against a screw plug in the back end of the tool. The screw plug, of course, tightens the tool. I also have splined the bar, as indicated, and by swiveling the standard can bore a very decent taper fit. The rig, with a full kit of cutters, makes a very welcome addition to any latheman's stock.

JESS GILCHRIST.

Toronto, Ohio.

Transforming an Old Shop Into a New One.

The late depression in business taught, or should have taught, manufacturers that in order to do business without loss, the plant must be suited to the work being done. Methods must be adopted to decrease cost in every possible way. Buildings must be adapted to the needs of the business and every effort made to facilitate the handling of material and the finished product.



A HANDY BORING TOOL.

If with existing facilities it is necessary during manufacture to move one piece of product twice, when by proper arrangements it need be moved but once, it is plain the cost of that particular movement or operation is reduced one-half.

There were, a few years back, and no doubt are now, plants where not only one, but many unnecessary movements of parts were made. Low prices and lack of orders were not the only causes of suspensions and shut-downs. The lack of good facilities, the hanging on to old tools and methods had more to do with it than anything else.

The usual method to cut down is to cut down wages of employees; it is so easily done, particularly if times are dull. In nine cases out of ten every time 10 per cent. is taken from a man's pay 20 per cent. is added to the cost of production. This is no guesswork, but an actual fact which can be readily demonstrated.

During the panic it was determined by the owners to completely remodel a large plant manufacturing at a loss steam engines and boilers of the agricultural class. The business had outgrown the capacity of the plant as it then existed. The buildings were old and in no way suited to the work being done. Many of the tools were good, but placed with no reference to a systematic passing of work from one to another. In order to get the best results, new buildings, or rather one new building, would have to be built, taking the place of and occupying the same ground as the old ones. It was necessary to keep the plant running while the building was going on.

Referring to Fig. 1, the full lines show the old buidings, the dotted lines the available ground. The new buildings were to cover the entire ground. The old blacksmith shop was to be moved to the space 60 by 80, marked "New B. S. Shop." The gallery design was adopted; the central area 40 feet wide, 36 feet high to the track for overhead crane; the gallery, 20 feet wide and 20 feet high from ground to floor, 20 feet from floor to roof; the building therefore was to be 80 by 400 feet long. By utilizing the 2½ feet at north end and 2 feet on each side of the old boiler shop there were 480 feet of new walls that could be started at once. All the old material possible was to be used in the new walls.

In order to keep the boiler-shop tools in running condition, all the inside framework and roof had to be shored in a sufficiently strong manner to insure their standing while the walls were demolished. This being done, board shutes were put up, and the bricks slid down, cleaned and used in the new walls. The shoring up was continued around the entire plant; temporary boarding put on the shoring posts; the old windows fastened to the boarding; thus all connection between the frame and brickwork and the interior was severed. A large force of men was put on, and the work pushed hard.

While the work on the walls was going on, the piers for receiving the steel columns were located and built. These piers in several instances came in contact with tools that were in use. Having moved these tools sufficiently to allow the piers to be built, they were belted up again and kept running.

As business is now, it would not be safe to undertake a building of any kind requiring steel in its construction until the necessary quantity was on the ground;

but at that time material of all kinds could be had promptly and in any quantity. The steel for this building was all delivered before there was need for it.

The most difficult part of the work was the erecting of these columns, which were 42 feet long. It was 15 feet from the ground to the first floor of the old building, 12½ feet from first floor to second and 12½ feet from second floor to roof. Girders from side to side spaced 18-foot centers, with posts underneath. By cutting out the first floor from girder to girder and the second floor from girder to beyond the next, as shown by Fig. 2, room was obtained to set up a mast, which was done, and rigged with a strong set of three-sheave blocks. The columns were brought into the shop through a door in the south end, caught near the end, lifted and passed forward and allowed to rest on girder, as shown in Fig. 2. They were then caught a few feet above the middle, lifted and swung to position. This operation was repeated until all the columns—thirty-eight in number—were in place.

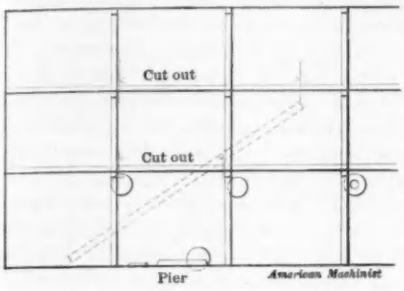


Fig. 2

METHOD OF GETTING NEW COLUMNS TO PLACE.

A description of this work is not a difficult matter, but the work itself was very troublesome. The shop floors were crowded with material, machinery and men. The risk of hurting someone or damaging tools or material kept everyone on a strain, so that as each column was securely fastened in place, a feeling of relief was felt by those in charge.

The connecting beams from column to column were lifted and passed through a door in the south end of the second story, their position on the columns being just above the first floor. They were in place by the time the walls were up to secure the beams for the gallery floors.

The beams on which the crane was to be placed, and which also received the rafters for gallery roof, were brought in and lifted in place by chain lifts attached to the top of the columns.

In order to allow the trussed rafters, spanning the 40-foot central area, to be lifted to place, it was necessary to cut an opening at the north end of the roof of the old boiler shop sufficiently large to allow the bridge of the electric crane to pass through. The track for it was laid, the crane put in place and a temporary engine set and belted to the generator. The crane was then put to work lifting the rafters. A lift of about 50 feet was necessary to put the rafters in place, but the lift of the crane was only 35 feet; therefore it was necessary to increase the travel of the lifting rope. A mast was set up on the top of the crane bridge, and being securely lashed and guyed, a single sheave block was attached to its top, a set of two sheave blocks was hung to the crane hook, the lower block being attached to the ground or to any convenient object of sufficient strength or weight to do the work; the tail rope was passed over the sheave at the top of the mast and down to the piece to be lifted. In this way rafter after rafter was easily and quickly put in position, until the three-story machine shop was reached. Here there was some delay, as the third floor had to be abandoned, and the roof and all above the floor torn down. However, in less than a week the rafters were all up and the roof on. The work from this on was plain and simple, requiring only push and energy to get the building completed before cold weather came on. The first brick was laid September 20, the entire building finished December 3, and the work of resetting tools and removing what was left of the old building commenced.

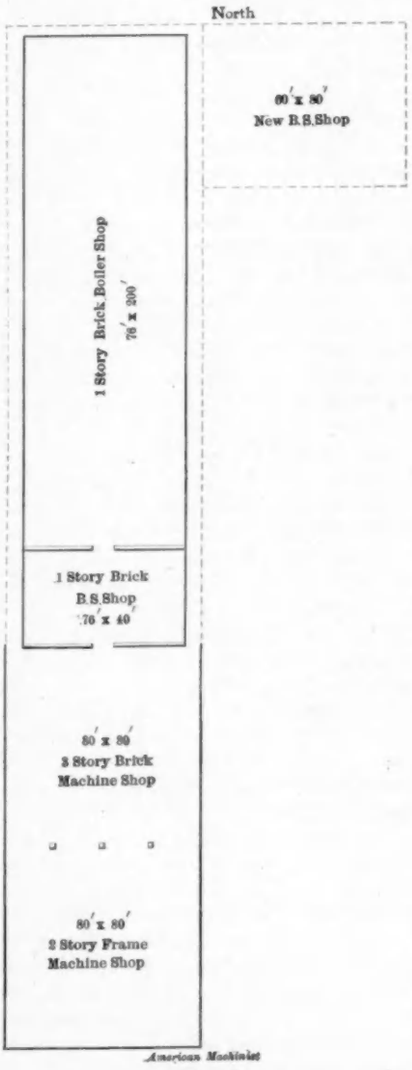


Fig. 1

PLAN OF OLD SHOP AND GROUND.

The completion of this new building and the installation of the electric crane were the first and most expensive steps in transforming a non-paying plant into a paying one, and some subsequent steps will be described hereafter. B. W. T.

Italian Engineering Works and the Development of the Italian Machinery Industry—Market for Machine Tools.

During the last fifteen years the Italian mechanical industry has made marvelous progress. Previous to 1881, Italy had to obtain from abroad iron, steel, boilers, engines and artillery of every description, the greater part being supplied by England, Germany and Austria.

The exhibition of Turin in 1884 showed that a considerable advance had taken place, due partly to special schools of technical education, and partly to the encouragement given by the authorities. The start then made in the Italian industries has been gradually extended by means of foundries at Terni, in Tuscany, in the Riviera Vobarno and Sestri Ponente; so that Italy can now provide for her ordinary requirements. As to naval construction, the late Admiral Brin has made Italy entirely independent of foreign aid, both as regards ironclads and artillery, the principal establishments being those of Ansaldo, Odero, Orlando, Messrs. Armstrong at Pozznoli, and Schwarzkopff at Venice, in addition to the state dockyards.

Messrs. Ansaldo & Co., of Sampierdarena, Sestri Ponente, and Genoa, have brought their works to such a state of efficiency that they are able to build both ships and their machinery of the largest size. At their shipbuilding works at Sesti Ponente they have built for the Italian Government the "Liguria," cruiser of 20 knots speed; the "Minerva," first-class torpedo catcher, 22½ knots, 850 tons and 4,000 horse-power, and a large number of sea-going torpedo boats. The first-class cruiser "Garibaldi," of 20 knots, 6,840 tons and 13,000 horse-power, which was laid down for the Italian Government, has been sold to the Argentine Republic. Another cruiser of the same class to replace her was at once laid down, and has been launched satisfactorily. At their Sampierdarena works many engines have been turned out, among these being the engines of 20,000 horse-power for the armor-clad "Sicilia," 10,000 horse-power for the fast cruiser "Marco Polo," 13,000 horse-power for the cruiser "Carlo Alberto," built at Spezia; 13,500 horse-power for the first-class battleship "Saint Bon," built at Venice, etc., etc. To meet the needs of the port of Genoa, Messrs. An-

saldo have also opened a repair shop at that place, within the harbor itself, and are doing a considerable amount of repairing work to the machinery and hulls of vessels. Messrs. Ansaldo have also acquired the patent rights for the Belleville boiler in Italy, and new works for their construction in Italy have been laid down at Sampierdarena. It may still be mentioned that one of Admiral Cervera's ill-fated cruisers, the "Cristobal Colon," was also built by Ansaldo. In all their various works, the Ansaldo Company employ at present 11,500 workmen, of whom 6,000 are at the shipbuilding yards of Sestri Ponente, 4,000 at the machine shops of Sampierdarena, and the rest at the foundries of Cornigliano and at the repair shops of Genoa.

Messrs. Odero & Co., of Sestri, are also engaged in the construction of all kinds of vessels. They have turned out many torpedo boats for the Italian navy, air-compressing engines for the government, and recently they built a large boiler-making plant of the most improved design.

The extensive works of Tardy & Benech, of Savona, have been taken over by the "Societá Alti Forni, Fonderie ed Acciajerie di Terni," turning out principally steel rails, steel plates and girders for ships, buildings, etc.

The shipbuilding yard at Leghorn has also been very active during the last few years. The Portuguese torpedo gunboat "Adamastr" was delivered in August, 1897, and the Argentine cruiser "General San Martin" left Leghorn in January, 1898. A gunboat, the "Beschir-es-Salameh," has been built for the Sultan of Morocco, and in course of construction is the Italian cruiser "Varese."

Busy during the recent years was also the Royal dockyard at Castellamara, where the large armored cruiser "Emanuele Filiberto" was safely launched in September, 1897; two other cruisers, the "Coatit" and "Agordat," were launched in 1898, and another large battleship has been put on the docks, but so far no name has yet been given.

At Naples there are the extensive shipbuilding and engineering works of Hawthorn-Guppy, which, in 1897, built the 18,000 horse-power engines for the Argentine cruiser "General San Martin" and the 13,500 horse-power engines for the above named battleship, "Emanuele Filiberto," and quite a number of other engines and large double-ended cylindrical boilers. This firm has been experimenting with water-tube boilers, and very successfully with two Greco boilers on board a torpedo boat. They have also had some very satisfactory results of other types of boilers made for experimental purposes.

The same progress has been made in the development dependent on railway construction. This progress is sufficiently shown by the fact that the single firm of Ernesto Breda & Co., of Milan, has constructed in recent years about 2,500 locomotives, of which quite a large number have been exported. Only recently this firm shipped forty-two large locomotives to Denmark.

Messrs. Breda & Co. employ some 1,200 workmen, and their shops are equipped with the most modern machinery and tools. The Bredas were the first in Italy to start the manufacture of steam threshing machines, and during recent years have turned out quite a number of them. The different shops of the Breda Company are superintended by well-trained engineers, and the work turned out is of the finest quality. In the two principal machine shops alone about 725 machine tools are in use, some of them being of American make.

The metallurgical establishment of MM. A. Migliavacca et Cie, in Upper Brescia, is almost the only place in Italy at which all stages of manufacture are followed. The mines, which produce a carbonate of iron, are in Bovegno, Val Trompio, and the blast furnaces at Tavernolo. The pig-iron is used at the puddling establishment at Vobarno, where are also situated the mills and furnaces. Iron sheets and plates, bars, rounds and squares and tubes constitute the principal products, the latter being the most considerable, and comprising welded tubes, cast and wrought-iron pipes, etc., of any diameter. The motive power at these works is hydraulic, and about 1,100 workmen are employed in the various departments.

A. Riva, Monneret et Cie, Milan, make a specialty of hydraulic machinery and turbines. They have already turned out 388 of the latter, with a total horse-power of 45,000, and have furnished the four large turbines at the electrical installation at Paderno, each machine indicating 2,160 horse-power. The works employ about 300 men.

Le Societe Ligure Metallurgique de Sestri Ponente undertakes the rolling down of steel ingots into sheets of from 2-10 millimeters up to 2 millimeters in thickness. Steam power is used at these works, and the production of sheets in 1896 amounted to 3,500 tons.

The firm of Carmine de Lucas & Sons, engineers and founders, Naples, which has been established over fifty years, produces miscellaneous iron, bronze and aluminum castings, alloys, etc., and also manufactures wrought ironwork, enamelled ware and boilers. This works, which employs 800 hands, does a large export trade, its production going largely to France, while its effect in reducing the imports of the manufactures in which the firm is engaged has of late years been considerable.

Tassara Frères, who own forges at Vottri, date from 1865. The works produce frames, nuts and bolts for locomotive and wagon builders, and is almost the only establishment of this description in Italy. Another department turns out rail chairs, and there are rolling mills for iron, and a foundry. The annual output is about 25,000 tons per annum, and the number of workmen employed is about 800. The power is derived from fifteen steam engines, of a total horse-power of 1,000.

G. Alzaiti, Milan, makes a specialty of spinning and carding looms and miscellaneous plant and macninery for silk and cotton mills.

The Milan Steel Foundry, established in 1888, makes steel and iron pipes and miscellaneous castings. A large proportion of the latter are for marine purposes, such as shafting, helical screws, eccentrics, etc. About 300 workmen are employed in the various departments.

Les Grandes Forges Italiennes de la maison Ing. G. Fossati et Cie, at Sestri Ponente, forge and finish large steel and iron machine castings. They also produce engines for marine and other purposes, locomotives, etc.

The Berliner Maschinen-Actien Gesellschaft vormals L. Schwartzkopff has a branch at Venice, established in 1886 on the invitation of the Italian Government. This establishment makes the self-acting torpedoes for which the Government possesses the sole rights, and employs about 200 workmen, the present Italian employees having replaced the German foremen and workmen who were imported in the the first instance.

Guiseppe Moneta, Milan, manufactures articles in stamped iron, this being the only establishment of this description established within recent years in Italy. The works consume imported material, but have had the effect of sensibly reducing the imports of enamelled ware from Germany. About 180 workmen are employed, and, besides the manufactures described above, M. Moneta produces miscellaneous iron and brass articles.

Alfredo Zopfi et Cie, Monza, make a specialty of mill machinery, which they also export to Switzerland, America and Marseilles. The engineering works occupy 280 workmen.

The metallurgical works and marble quarries of Guiseppe Boselli & Sons, at Valventosa and Querceta, have been established for about fifty years. They comprise forges, mills and engineering shops, and produce, among other tools, machinery for quarrying and working marble.

M. Carlo Volpi, at Milan, has works at which aluminum is worked into various forms. This establishment dates from 1890, and produces domestic utensils, ornaments, clocks, etc.

At Bolzaneto is the forge and steel works of Dufour et Bruzzo, dating from 1888. Established to roll both steel and iron, only the former is now operated. Dolomite linings are made here, as well as refractory firebricks, the power being derived from five Tosti machines, developing 700 horse-power. The works employ 300 workmen.

The Pra Works of Gerolamo Ratto fu Giovanni is an important works employing 600 hands. Sixteen engines, develop-

ing 1,600 horse-power, furnish the motive power. The firm produces tram rails, bridge work and roofing, and can turn out 45,000 tons of material per annum. There is also a gas and water-pipe foundry.

The engineering and hydraulic works belonging to Luigi Cominacini, at Cremona, make hydraulic machinery. This firm also produces tins for preserving foodstuffs.

This by no means completes the establishments that might be enumerated at Leghorn, Brescia, Udina, Naples, etc., but serves to point out in a forcible manner how great the progress of the last few decades in Italy has been.

It appears, however, that the most extensive development of the manufacture of machinery has been in connection with electric apparatus, which is exported in large quantities, not only to South America, but to most European countries, including Great Britain and Germany. Thus, for instance, in 1897, the exports of electrical machinery amounted in value to 749,120 lire.

There is no doubt that throughout the whole of Italy manufacturing industries are well under way. The growth of the industry may also be gathered from the fact that the number of steam boilers in use in industrial works inland rose from 14,502 in 1890 to 19,318 in 1897. By far the largest number of boilers is to be found in the Province of Milan, and perhaps the greater part of them in the city of Milan itself, where manufacturing industries are rapidly assuming large proportions. Turin, with its numerous industries, comes next, although here the increase has not been so large as in Lombardy.

This growing activity in the home engineering industry creates, of course, an increasing demand for machine tools, and in these American manufacturers should by all means and under all circumstances be able to get a greater share of the trade. Very few American tool makers are directly represented, *i. e.*, on the spot, and most of our tools which find their way to the Italian shops are imported via Berlin, Paris, or London. This is a great drawback to the development of the trade. The Italians are, generally speaking, a proud people, and if they want American goods then they want them from America, and not in the shape of second-hand sales. There can be not the slightest doubt that if American manufacturers would more carefully cultivate the Italian market, study the requirements of the Italian engineering works, keep up closer connections with the consumers and visit from time to time the field, our exports of tools could be increased to a large extent. If the fact is considered that Italy imports yearly machinery to the value of about $7,000,000, to which less than 2½ per cent. is contributed by the United States, it will be readily understood that there is still room in Italy for American made machinery.

The Italian statistics, unfortunately, classify machine tools (metal working machines) together with the item of "wood-working machines," so that no distinct figures on the machine tool import trade are available. The importation of these two combined items amounted, in 1897, in total value to 1,283,620 lire, contributed as follows:

By Germany.....	798,580	lire
" England.....	252,245	"
" France.....	85,935	"
" Belgium.....	78,560	"
" United States....	35,465	"
" Switzerland.....	17,205	"
" Austria.....	15,640	"

From these figures it will be seen that Germany stands far and away at the top of the trade, followed next by Great Britain. The United States are even outranked by France and Belgium, though these two countries import large quantities of machine tools from the United States for their own machine shops. Thus, in the fiscal year ended June 30, 1898, our machine tool exports to France amounted in value to $577,165, and those to Belgium to the value of $252,444.

If American manufacturers would issue their catalogs and all printed matter in Italian, and give them a large circulation among the engineering works, the result would not be unsatisfactory. Though all Italian iron masters understand French, yet a catalog printed in Italian would greatly facilitate the business, as catalogs in the language of the country may be given to an engineer, to a foreman or a toolmaker who does not understand French, and it is a well-known fact that very often, before ordering a new machine or a new tool, the manager or superintendent of the works talks the matter over with his engineers and foremen.

Another point well worth close attention is the metric system. To this we *must* adapt ourselves if we ever want to get into the heart of the Continental trade.

And last, but not least, prices should best be quoted c. i. f. Genoa, cost to include insurance and freight as far as Genoa. There are different lines regularly running between New York and Genoa, and freight rates are, as a rule, low.

That all correspondence should preferably be carried on in Italian—or at least in French—is a matter of course.

H. L. G.

The Field of Experimental Research.

The above is the title given to the vice-presidential address of Prof. Elihu Thomson at the Columbus meeting of the American Association for the Advancement of Science. The address was an unusually suggestive one, as may be gathered from the one or two extracts which we are able to reproduce. The portions given are, except the last paragraph, from the beginning of the paper, which was very long, and in the body of it traversed vasty deeps into which many of our readers would not care to plunge.

"Physical research by experimental methods is both a broadening and a narrowing field. There are many gaps yet to be filled, data to be accumulated, measurements to be made with great precision, but the limits within which we must work are becoming, at the same time, more and more defined.

"The upper ranges of velocities, temperatures and pressures, which manifest themselves in the study of the stellar universe, are forever beyond the range of experiment. But while the astronomer must wait for opportunities to observe, the experimenter can control his conditions and apply his methods and his apparatus at once to the question in hand. Still this work must be done within a certain range or must be limited to conditions more or less easy to recognize. In spite of this fact, however, the progress made during the past century is not likely to cease or abate in the next, and the ever-increasing number of workers bodes well for the future enrichment of our science.

"The development in the field of research by experiment is like the opening of a mine, which, as it deepens and widens, continually yields new treasure, but with increased difficulty, except when a rich vein is struck and worked for a time. In general, however, as the work progresses there will be needed closer application and more refined methods. We may indeed find our limit of depth in the mine of experiment in inordinate cost, in temperatures too high, or in pressures beyond the limits of our skill to control.

"It is but a few months since Professor Dewar, by the evaporation of liquid hydrogen in a vacuum, closely approached, if he has not reached, our lower limit of possible temperature. Investigations of the effects of low temperature upon the properties of bodies must from the present outlook be forever limited to about 20 degrees C. above absolute zero; unless, a lighter gas than hydrogen be discovered upon the earth, the actual existence of which it is, of course, impossible to conjecture. Before the actual experimental demonstration of this limit, the limit itself was known to theory, at least approximately, but the spur of the experimenter is the overcoming of difficulties and the possibility of new discoveries which come as surprises. In the case in question a liquid of extremely low density, only one-fourteenth that of liquid nitrogen, was produced, while still defined by clear and well-marked refracting surfaces.

"When we turn to the consideration of the field for research work at high temperatures we are not confronted by the fact of a physical limit existing; which may be approached but never reached.

We can imagine no limit to possible increase of temperature, such as is the absolute zero limit of decrease. While we may actually employ in electric furnaces temperatures, which, according to Moissan, have a lower limit of 3,500 degrees C., we can realize the possibility of temperatures existing in the stars measured by tens of thousands or hundreds of thousands of degrees of our temperature scale.

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"As with the temperature range, so it is with the pressure range. We may easily work under conditions which involve no pressure, but when we attempt to conduct our inquiries with increase of pressure, we soon find a limit to the tenacity of our strongest vessels, or to our ability to produce and maintain extreme pressures. We may work, not easily it is true, with pressures up to a few tons to the square inch, but this is as nothing compared with the condition which we know must exist within the larger celestial bodies; without reference to their condition, solid, liquid, or gaseous. Can we ever hope to experimentally reproduce the condition of a mass of gas so compressed that in spite of a very high temperature its volume is less than that of the same mass cooled to solidification? Yet this extreme of condition must be the normal state within the bodies of many of the stars.

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"It has been aptly said that many, and perhaps most, of the important discoveries have been made with comparatively simple and crude apparatus. While this may be true, yet it is probably true also that future advance work is likely to require more and more refined means and greater nicety of construction and adjustment of apparatus. The expense or cost, if not the difficulty of the work, may become so great as to effectually bar further progress in some fields. When instruments require to be adjusted or constructed to such refined limits as a fraction of a wave length of light, but few can be found to undertake the work. The interferometer and echelon spectroscope of Michelson involve such minute adjustments that a wave length of light is relatively thereto a large measure. It is well known that this comparative coarseness of light waves imposes a limit to the powers of optical instruments, as the microscope and telescope, such that no perfection of proportion, construction and correction of the lenses can remove.

"In most fields of research, however, progress in the future will depend in an increasing degree upon the possession by the investigator of an appreciation of small details and magnitudes, together with a refined skill in manipulation or construction of apparatus. He must be ready to guide the trained mechanic and be able himself to administer those finishing touches which often mark the difference between success and failure. There must be in his mental equipment that clear comprehension of the proper adjustment of means to end which is of such great value in work in new fields. He must also learn to render available to science the resources of the larger workshops and industrial establishments.

"The application of physical principles upon a large scale in such works has frequently, in recent years, resulted in great gains to science itself. The resources of the physical laboratory are often relatively small and meagre compared with those of the factory. Experimental work in certain lines is now frequently carried on upon a scale so great and under such varied conditions as would be almost impossible outside of a large works.

* * * * * *

"Could Volta, when he discovered the pile one hundred years ago, have had any idea of its importance in practical work? Or, did Davy or his contemporaries at the time of his experiments with the arc of flame between the charcoal terminals of his large battery, have any suspicion that in less than one hundred years the electric arc would grow to such importance that more than 100,000 arc lamps would become a single year's production in this country alone? Faraday, when he made his researches upon the induction of electric currents from magnetism, could not have had any idea of the enormous practical work in which the principles he dealt with as facts of pure science, would find embodiment. When he wound upon the closed iron ring the two coils of wire which enabled him to discover the facts of mutual induction, he had begun, without any suspicion of the fact, the experimental work which gave to science and to practice the modern transformer now built of capacities ranging up to 2,500 horse-power each, and for potentials of 40,000 to 60,000 volts.

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"The endeavor in the foregoing rather disconnected statements has been to indicate directions in which the field of experiment may be extended, and to emphasize the fact that research must be carried on by extension of limits, necessitating more liberal endowment of research laboratories. I have tried to make it clear that the physicist must avail himself of the powers and energies set in play in the larger industrial enterprises, and finally that the field of possible exploration in physics by experimental methods has its natural boundaries, outside of which our advances in knowledge must be derived from a study of celestial bodies.

* * * * * *

"Scientific facts are of little value in themselves. Their significance is their bearing upon other facts, enabling us to generalize, and so to discover principles just as the accurate measurement of the position of a star may be without value in itself, but in relation to other similar measurements of other stars, may become the means of discovering their proper motions. We refine our instruments, we render more trustworthy our means of observation, we extend our range of experimental inquiry, and thus lay the foundation for the future work, with the full knowledge that although our researches cannot extend beyond certain limits, the field itself is, even within those limits, inexhaustible.

Duration of the Present Activity.

How long the present era of prosperity is destined to continue is a question vexing many minds. The following discussion of the question is from an interview for the "American Machinist" with Mr. H. T. Patterson, of the firm Patterson, Gottfried & Hunter, Limited, of this city:

"The duration of this epoch of prosperity is a question to which I have given considerable thought, and upon which I have talked with various men I have met whose opinions have weight. A period of activity is naturally followed by a reaction in course of time. I have been inclined to concede to the present boom at least one more year. Some others, however, give it a longer life—even as long as four years. A manufacturer whom I lately met in one of the Eastern States, and who by nature is very conservative and little disposed to predict a boom, shows no hesitation in prophesying a continuance of this one and gives it four years to last. Some bankers with whom I have talked name two years. President Calloway of the New York Central is understood to allow as much as three years in his estimate. The policy of that road in increasing its capital stock $15,000,000 for the purchase of new rolling stock, etc., shows that those in charge have implicit confidence in the future. On the other hand, I have met a cotton mill man from the South who is willing to take any quantity of orders for any time of delivery at present prices.

"We are without precedent in estimating the future, for never before has there been just the same combination of circumstances. The activity of which we are now in the midst has come upon us with unusual suddenness. Again, an important factor to be considered is the growth of our foreign markets by the opening up of new countries to civilization and trade. Never before was there such rapid progress in this respect as there is to-day. Ten years will now accomplish what would have required a hundred years at the rate things were progressing at the beginning of the century. The building of a railway in the Congo, opening up, it is said, 100,000 square miles of navigable river, the construction of the Atbara Bridge, the opening up of China—all are illustrations of this rapid development.

It would seem that the world has changed sufficiently since 1893 to insure a much larger total volume of business than then, even when the time does come that we shall have to return to another period of depression.

"It will not do to ignore the fact that while our markets have been so widely extended our production has greatly increased. Where, four or five years ago, we were making perhaps 7,000,000 tons of pig iron, we are now producing some 14,000,000 tons, and with the furnaces at present under construction will soon have an output 1,000,000 tons greater. But the danger of overproduction in the near future is greatly lessened by the scarcity of pig iron abroad. Germany is almost bare of iron. A recent consular report states that there is an agitation in that country to reduce the duty on iron. Great Britain, too, is behind on her orders. These conditions will tend to maintain our prosperity longer than otherwise might be expected.

"Evidence leading to a belief in continued activity is found in our own business. It is natural that this should reach a maximum for the season in October, and then taper off as the year wanes, but from the general appearance of things in our store, although I have not yet received definite figures, it would seem that the tendency of business is to continue on the increase rather than to decrease. The orders we receive are for consumption, and they show that the manufacturers are busy and need the supplies. Electrical manufacturers, for instance, are buying freely. This morning's mail brought fifteen orders from one of them and five from another.

"One could hardly expect iron and steel to advance indefinitely from their present prices—though, after all, in the face of the season's conditions, it is not safe to say what they won't do. But the tendency of finished goods, apparently, is still upward, rather than downward. While crude materials have about doubled in value, manufactured products have not yet generally increased proportionately.

"If an answer were attempted to the question whether prices will ever sink back to their old basis, there should be considered a factor to which I have not seen attention publicly drawn. This is the change in our standard of measuring values. The increased volume of gold resulting from its continual production bids fair so to alter the relations between currency and merchandise that prices would not sink to their former level in the event of a return to old conditions in other respects.

"This is a Pennsylvania town," said Mr. Wheeler to his wife. "We crossed the State line a few miles back." "Oh, how nice!" said Mrs. Wheeler, as she dismounted from her bicycle. "Where is the Carnegie Library?"—"Harper's Bazar."

Col. Philander P. Lane.

Col. Philander P. Lane, senior member of the Lane & Bodley Company, of Cincinnati, Ohio, died December 6, at his home in Norwood, Ohio, at the age of seventy-eight years, after a lingering illness. Colonel Lane was born at Nassau, near Albany, N. Y., and when seven years of age moved with his family to Portage County, Ohio, where his father was a pioneer settler. As a young man he entered the employment of a machinist in Cleveland, Ohio, and in 1848 went to Cincinnati and opened a small repair shop. Four years later the machinery firm of Lane & Bodley was formed by Mr. Lane in conjunction with Joseph T. Bodley. At the outbreak of the civil war Mr. Lane was mustered into service as captain of a company of the Eleventh Regiment of Ohio Infantry, and served throughout the war, becoming Colonel of his regiment. At the close of hostilities Colonel Lane re-engaged in the rapidly increasing business of his firm. Mr. Bodley died in 1868, and from that time the management of the entire business devolved upon his partner, who conducted it until he was attacked by a stroke of paralysis about ten years ago. Colonel Lane was one of the foremost and most public-spirited men of Cincinnati, and was prominent alike in business, philanthropic and social circles. He was one of the founders of the Cincinnati Board of Trade, and an active promoter of the Cincinnati Industrial Expositions.

The business has for some time past been conducted by Colonel Lane's son, Harry M., who is now assisted by a younger brother. The shops of the Lane & Bodley Company have been a training school for very many of those who are now known as among the best mechanics and engineers of Cincinnati and vicinity.

Personal.

Francis Fenwick, of Fenwick Freres & Co., Paris, importers of American machinery, sailed for Europe on the 14th inst., per S. S. "La Gascogne."

Allan R. Rea, who, until recently, was connected with the W. F. & John Barnes Company, Rockford, Ill., has resigned to become secretary of the B. F. Barnes Company, of the same city.

B. Frank Barnes, of Rockford, Ill., has severed his connection with the W. F. & John Barnes Company, same place, and will fill the position of president of the newly formed B. F. Barnes Company at Rockford, Ill.

The many friends of Prof. J. G. A. Meyer, who was for some years an associate editor of this journal, will regret to learn that he suffered a stroke of paralysis about a month ago. He is, however, recovering from its effects, and is able to get into the city twice a week to attend to his publishing business.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 16.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M. Wks.,Waltham,Mass.

Rawhide, fibre and hard rubber gears. The Arthur Co. (See page 8.)

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

Parallel attachments for drawing board or table, $1.50. F. G. Hobart, Beloit, Wis.; cir'lrs.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

For Sale—Two geared Ferracute presses, 62 in. between uprights; little used, and in good condition. Address W. H. Mullins, Salem, Ohio.

Mechanical engineer solicits correspondence with capitalists or manufacturing concerns who want to build an improved high-speed engine. Box 52, AMERICAN MACHINIST.

Would be pleased to correspond with parties having some specialty in the line of machinery to build, by one of the best equipped machine shops in the State. Address Box 475, Hornellsville, N. Y.

For Sale—A valuable patent on cutting-off tool-holder, especially adapted to screw machine; one desiring to manufacture this tool will reap a harvest well worth looking into. Address Box 68, AMERICAN MACHINIST.

Engineers, firemen, machinists and electricians, send 10 cents for 24-page pamphlet containing list of questions asked by Examining Board of Engineers. Geo. A. Zeller, bookseller, St. Louis, Mo. Mention AMER. MACH.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Experienced engineer, well connected throughout Great Britain and the continent, desires agencies for good American machinery of all kinds; has exceptional facilities for selling patents or arranging for manufacture under royalties; British and American references. Address Brown & Co., 49 Deansgate, Manchester, England.

The annual meeting of the stockholders of the American Machinist Press, for the election of five directors for the ensuing year and for the transaction of such other business as may properly come before the meeting, will be held at the office of the company, No. 218 William street, in the city of New York, on the 8th day of January, 1900, at 12 o'clock noon. A. LEIGHTON DONNELL, Secretary.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisement under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Wanted—Foremanship of iron foundry, by foreman, experienced on engine and general jobbing work. Address Box 83, AM. MACH.

A1 metal pattern maker on gas and steam fittings and miscellaneous malleable iron work, 20 years' experience as foreman, would like to make a change. Box 69, AMER. MACH.

Draftsman, age 28, experienced in designing steam pumps, engines, ice machines, printing presses, air compressors, etc., wishes employment. Box 82, AMERICAN MACHINIST.

Position wanted as manager or general superintendent; thoroughly practical and familiar with modern methods and practice in foundries, machine shops, etc. Box 70, AMERICAN MACHINIST.

A man possessing a thorough scientific knowledge of steam engineering, with many years' practical experience, desires a change

(*Continued on page* 40.)

Not so Militant, Perhaps.

"Feilden's Magazine" is sometimes rather funny in being "militantly British," and we wonder what its readers who have been led to expect it to defend at all times and to stoutly maintain the superiority of everything British, will think when they see in its issue of December the following suspicious, if not treasonable, utterance:

"In fact, it is becoming very evident that British makers have not kept pace with their American competitors either in respect to design or in the methods adopted for dealing with the present large demand for tools."

We have ourselves thought that British machine builders were in the habit of receiving statements of plain, though perhaps somewhat disagreeable, truths with more equanimity than our own, but somehow we had imbibed the perhaps mistaken notion that "Feilden's Magazine" based its "militantly British" programme upon a different idea. The quoted expression accords with what other English journals not "militantly British" are in the habit of saying, and thus the new is reduced (or is it elevated?) to the same plane as the old.

Another statement in the same article is as follows:

"The skill of the handicraftsman, which in bygone days counted for so much, is now secondary to, if not quite altogether superseded by, labor-saving machinery. It is, indeed, not too much to say that the nation which possesses the best and the amplest stock of labor-saving machinery must lead the van of progress. Such a position Great Britain has undoubtedly occupied in modern history. Whether she occupies it now is a matter for consideration."

Here is a curious mixture of truth and error. There is, as a matter of fact, more call for high skill in men than ever before, and whether a nation which possesses good machinery will go to the front or not depends a little, at least, on how the machinery is used. Spain had some very good fighting machines in the harbor of Santiago, but she lacked in the men skilled in their use, and highly skilled men are and will always be vitally important.

New Catalogs.

The L. S. Starrett Company, Athol, Mass., has issued a new catalog describing their very complete line of machinists' tools, including rules, squares, calipers, gages of various kinds, straight-edges. The catalog is 5¼x7½ inches and contains 112 pages.

The Standard Voting Machine Company, Rochester, N. Y., has issued two small catalogs in which is illustrated and described the Standard voting machine. The features of this machine are gone into with some detail, and a number of testimonials and press opin-

(*Continued on page* 41.)

Situations Wanted—Cont'd.

of position after January 1. Address Box 71, AMERICAN MACHINIST.

Wanted—Position as foundry foreman, by a reliable, experienced molder; can manage men to advantage to get best results; here is a chance to get a good man. Address C. Dhein, 229 Park st., Dayton, O.

Mechanical engineer, technical graduate and 18 years' experience in hydraulic, steam and general machinery, wants position as assistant superintendent or chief draftsman; first-class designer. Box 53, AMERICAN MACHINIST.

Superintendent desires to change January 1; position as superintendent or manager desired; have had charge of light duplicate machinery, also engine work; competent to handle large force of men; references. Box 72, AMERICAN MACHINIST.

Mechanical engineer, familiar with hydraulic engineering, general machinery and water-wheel construction, is open for engagement January 1; invites correspondence from water-wheel builders wanting to improve upon the efficiency of their wheels. Box 55, AMERICAN MACHINIST.

Help Wanted.

Machinists wanted; regular work and good pay to competent men. Watertown Engine Co., Watertown, N. Y.

Draftsman wanted on mill machinery and machine tools. Apply to Bethlehem Steel Co., South Bethlehem, Pa.

Wanted—First-class tool makers; fine work; pleasant shop; good pay; steady job. Veeder Mfg. Co., Hartford, Conn.

Wanted—Good up-to-date lathe hand, used to heavy work, to take charge of a few hands. Address Box 75, AMERICAN MACHINIST.

Wanted—A man to take the lead in foundry on cylinder work, in a locomotive works. Address Box 66, AMERICAN MACHINIST.

Wanted, Immediately—Two or three first-class draftsmen, capable of designing machinery. Apply The Bucyrus Co., South Milwaukee, Wis.

Wanted—In Massachusetts, four first-class outside and inside erecting men on engine and air-compressor work. Address Box 63, AMERICAN MACHINIST.

Superintendent to take charge of engine works employing 100 to 200 men; state age, nationality and previous experience. Box 80, AMERICAN MACHINIST.

Wanted—Four first-class machinery pattern makers; steady work to good hands. Apply at once, Townsend Furnace & Machine Shop Co., Albany, N. Y.

Draftsman; competent man; one used to woolen or cotton-mill machinery preferred; state age, experience and salary expected. Box 74, AMERICAN MACHINIST.

A good mechanic, who can do rapid and accurate work drilling on a drill press, to take charge of a drilling department. Address Box 76, AMERICAN MACHINIST.

Wanted—Experienced foundry foreman for Corliss and other heavy work; permanent employment and good salary assured. Address Box 81, AMERICAN MACHINIST.

Wanted—Chief draftsman and designer on Corliss and slide-valve engines and air compressors; excellent and permanent position for right man. Box 78, AMER. MACHINIST.

Wanted—Energetic man to sell machinery on road; must be a practical mechanic with thorough knowledge of use of milling machines. Address V. C. E., AMER. MACHINIST.

First-class machinist, accustomed to running heavy machine tools; must be a live man; one who is capable of taking charge of a department. Address Box 77, AM. MACH.

Wanted—Experienced draftsman, to work on cotton machinery; good position for an A1 man; state experience, references and salary expected. Address Box 64, AMER. MACHINIST.

Wanted—Competent superintendent, familiar with engine and pump work, to take charge of foundry and machine plant; must be conversant with latest shop practice. Box 79, AMERICAN MACHINIST.

Wanted—An ice machine company desires to employ a first-class draftsman familiar with piping up of power plants; man with practical experience preferred; state experience and wages wanted. Box 60, AM. MACH.

Wanted—Three or four good general machinists and one sheet iron worker for regular work in machine shop; good pay and steady work to competent men. State age and experience to Kenney & Co., Scottdale, Pa.

Wanted—Three thoroughly experienced machinery blacksmiths, accustomed to working to drawings; also one foreman blacksmith capable of handling 40 men on general work, including high-class machine forging. Address Box 61, AMERICAN MACHINIST.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from draftsmen, pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—A competent machinist, with executive ability, to take charge of the tool department of a large manufacturing establishment; the work consists of repairs and new tools; good pay to the right man. Address, stating experience, Box 73, AM. MACH.

Wanted—One or two bright young men, to buy established machine shop in New York, doing good business; is fitted up with best of modern tools, and we will send to party buying, all our trade in this line; an exceptional chance for the right party to start in business, and terms will be made satisfactory to purchaser; price low. Address O. G. N., Box 30, AMERICAN MACHINIST.

MECHANICAL ENGINEERS AND DRAFTSMEN

WANTED.

Capable and Experienced Men should become acquainted with us.

Our business is to secure good positions for first-class mechanical, civil and electrical engineers and draftsmen.

WRITE US, stating your experience briefly, and we will send you the necessary papers to be filled out in full.

The Engineering Agency,
1605 Monadnock Block, CHICAGO, U.S.A.

SAVED $250 BY AN INVESTMENT OF **$15.**

One large concern writes us that in three years it has saved $250 on its oil bills through the use of a

$15 Cross Oil Filter.

Wouldn't you like to try one for 30 days? Send for Catalog 16.

THE BURT MFG. CO.,
AKRON, OHIO, U. S. A.
Largest Manufacturers of Oil Filters in the World.

HINDLEY WORM GEARING.
MORSE, WILLIAMS & CO.,
PHILADELPHIA, PA.

We Want to Build Machines

or machine parts, by contract, and to finish first-class Brass Castings. We have a Modern Machine Shop, Brass Foundry and Coppersmith Shop, and every facility for doing these things well. Tell us what to figure on.

J. B. Chapman & Co., Springfield, Mass.

SHELL AND SOLID REAMERS,

With Patent Spiral Flutes. Arbors, Mandrels, Taps, Dies, Screw Plates, Tap Wrenches, Bolt Cutters, Drilling Machines, Etc.

SEND FOR CATALOG.

WILEY & RUSSELL MFG. CO.,
Greenfield, Mass., U. S. A.

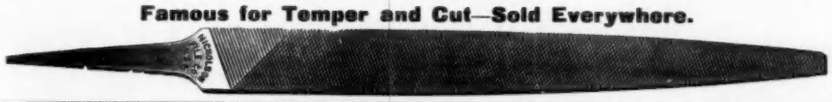
Agents in London: SELIG, SONNENTHAL & Co., 85 Queen Victoria St.

NICHOLSON FILE CO., - **Providence, R. I., U. S. A.**
SAM'L M. NICHOLSON, Pres. & Gen. Mgr. .....LARGEST MAKERS IN THE WORLD.

Sold to the Leading Concerns in Every Civilized Country.
Supplied to 20 Foreign Governments.

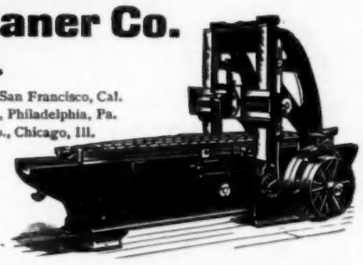
NICHOLSON

Famous for Temper and Cut—Sold Everywhere.



Woodward & Powell Planer Co.
WORCESTER, MASS.

U. Baird Machinery Co., Pittsburgh, Pa.
Robinson & Cary Co., St. Paul, Minn.
W. R. Colcord Mchy. Co., St. Louis, Mo.
Parke & Lacy Co., San Francisco, Cal.
The Fairbanks Co., Philadelphia, Pa.
Pratt & Whitney Co., Chicago, Ill.
De Fries & Co., Dusseldorf and Berlin, Germany.
A. Janssens, Paris, France.
A. Janssens, Bruxelles, Belgium.
Burton, Griffiths & Co., London, Eng.
Sonessons & Co., Malmo, Sweden.

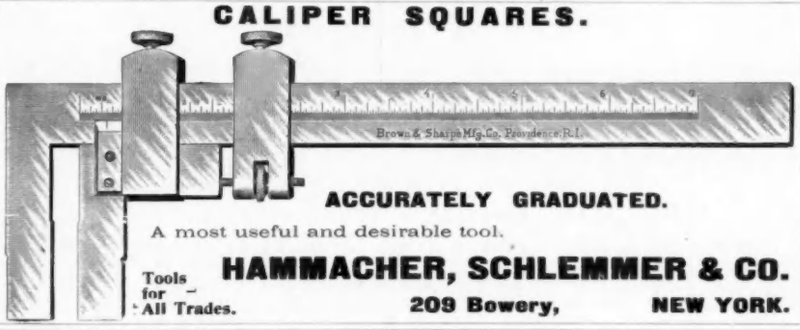


We Claim the Following Merits for . . . . . Jenkins Bros.' Valves.

1. *Manufactured of the best Steam Metal.*
2. *No regrinding, therefore not constantly wearing out the Seat of the Valves.*
3. *Contains JENKINS DISC, which is suitable for all Pressures of Steam, Oil and Acids.*
4. *The Easiest Repaired, and all parts Interchangeable.*
5. *Every Valve Tested before leaving the factory.*
6. *ALL GENUINE stamped with Trade Mark.*

Jenkins Brothers, New York, Philadelphia, Chicago, Boston.

CALIPER SQUARES.

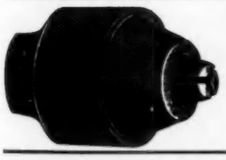


ACCURATELY GRADUATED.

A most useful and desirable tool.

Tools for All Trades.

HAMMACHER, SCHLEMMER & CO.
209 Bowery, NEW YORK.



Almond Drill Chuck.
Sold at all Machinists' Supply Stores.
T. R. Almond,
83 & 85 Washington St., Brooklyn, N. Y.

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS AND IMPORTERS,
810 WALNUT ST., PHILADELPHIA.
Our New and Revised Catalog of Practical and Scientific Books, 88 pages, 8vo, and our other Catalogs and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to anyone in any part of the world who will furnish his address.

KINEMATICS OF ...MACHINERY

A Brief Treatise on Constrained Motions of Machine Elements. By **John H. Barr, M.S., M.M.E.,** Professor of Machine Design, Sibley College, Cornell University, Member of the American Society of Mechanical Engineers. With over two hundred figures. 8vo. v+247 pages. 213 figures.
CLOTH, $2.50.

JOHN WILEY & SONS, - 53 E. 10th St., New York City.

WANTED,

A manufacturer to furnish machine of guaranteed efficiency for manufacturing Empty Gelatine Capsules. Send offer and sketch to

I. C. 8622,
care of Rudolf Mosse,
BERLIN, S. W., GERMANY.

CLEVELAND GEAR WORKS

W. R. SAWYER, Lessee.
86 Seneca Street,
CLEVELAND, OHIO.
Gear Wheels and Gear Cutting
Of all descriptions.
Get Our Prices.

(*Continued from page* 40.)

ions on the machine are given. Both catalogs are standard size, 3½x6 inches.

We have received from the Ridgway Dynamo & Engine Company, Ridgway, Pa., a copy of their new catalog. The catalog is devoted to very thorough and complete descriptions and illustrations of the Thompson-Ryan dynamo and the McEwen automatic engine. The construction of both these machines is given very minutely and quite a number of illustrations assist greatly in the better understanding of statements made. The catalog should be of decided interest to those who have to do with the installation of this class of machinery. It contains 104 8x10-inch pages, and copies will be furnished on application accompanied by business card.

Manufacturers.

Pennsylvania Iron Works Company, Philadelphia, is to add another story to machine shop.

The Darby Manufacturing Company, Coneautville, Pa., intends erecting a brick and iron factory building at Krug, Md.

William Steele & Sons will build for Thomas Henry & Sons a three-story factory addition, 7 by 18 feet, on Tioga street, west of Trenton avenue, Philadelphia, Pa.

F. A. Griffin, of Chicago, has purchased the plant of the Kansas City (Mo.) Car & Foundry Company, and will carry on the manufacture of car wheels.

The tannery works of Uriah Cassell & Son at Hoernerstown, Pa., which were recently destroyed by fire, are to be rebuilt and equipped with the latest improved machinery and power apparatus.

Johnson & Noyes have just opened an office at 1522 Monadnock Block, Chicago, where they will represent the firm of Beaudry & Co., Boston, Mass., manufacturers of power hammers and forging presses.

J. Kerr, of Eddystone, Pa., builder, has been awarded the contract for the erection of a new power house and plant at Bridgeton, N. J., for the American Railways Company, of Philadelphia and Bridgeton. Work will be started at once.

Reading, Pa., is to have another new industry in the shape of a glove and mitten factory. Among those interested in the enterprise are John Barbey, Ferdinand Goetz, A. J. Brumbach, Emil O. Spindler, Mrs. Catharine Archer, John M. Archer, Ferdinand Winter, C. H. Ruhl and John H. Maltzberger.

The Berlin Iron Bridge Company, of East Berlin, Conn., are about to complete a new machine shop for the American Ordnance Company, of Bridgeport, Conn., with traveling cranes, runways, etc. The building is to be covered with the Berlin Iron Bridge Company patent anti-condensation corrugated iron roof covering.

C. F. Simminin's Sons will build a brick and iron addition to their thread factory, at Trenton avenue and Clearfield street, Philadelphia, Pa., from drawings which were recently completed by Architects Stearns & Caston. Stephen Girard Building. Plans show a building with stone trimmings, measuring 16 by 70 feet, and work will soon be started under owners' supervision.

The Illinois Steel Company recently announced that it contemplates making improvements at its Milwaukee plant that will cost $3,500,000. The plan as outlined by Superintendent Ries is that it will erect six additional mills. Two will be blast furnaces, two rolling mills and two for the manufacture of steel by the Bessemer process. The improvements contemplated will be begun next spring. The new mills will give employment to 1,200 additional men.

He's writing for our Catalog J, which fully describes the following standard drop-forged tools

We've a stock of over 100,000 Wrenches—over 185 different styles and sizes. We guarantee the quality of our product. You don't get anything faulty if we see it first. The heads of our Wrenches are at a 15 degree angle with the handle, to permit of working in corners. We're the originators of this feature, by the way.

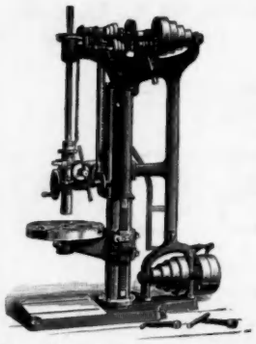
J. H. WILLIAMS & CO.,
9-31 Richards Street, BROOKLYN, N. Y.

A Mould and Ladle combined for making soft metal Hammers. Price complete with one Hammer, as shown, $1.50 and $2.00. 3½ and 6 lbs.

CHARLES H. FIELD, 234 Chestnut St., Providence, R.I.

There Is No Metal That Vitrified Emery and Corundum Wheels will not cut. Send for Catalog.

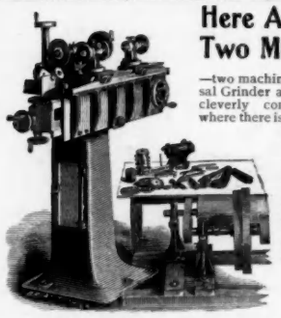
The Vitrified Wheel Co.
Westfield, Mass., U.S.A.



Cincinnati Upright Drills.

WE build nothing else, but build these drills to do the business. You would be surprised if you knew just how much one of our 24-inch machines will do. We can't use this space to tell it, as some fellows are not interested, but if you are, write us and see how quick you will get that surprise.

Cincinnati Machine Tool Company,
Western Ave. and Dayton St., CINCINNATI, OHIO, U.S.A.



Here Are Two Machines—

—two machines in one—a Universal Grinder and a Cutter Grinder cleverly combined. In shops where there is not enough grinding to keep a machine of each kind busy, this Universal and Cutter Grinder will do the work and do it in the right way. Made by a maker who has a reputation to sustain and made in a way that is calculated to sustain it.

Catalog and full particulars on request.

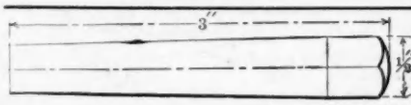
A. FALKENAU, 109-115 North 22d Street, PHILADELPHIA, PA.

NEW HAVEN MFG. CO.

Manufacturers of

SHAPERS, SLOTTERS, PLANERS, LATHES, DRILLS, Etc.

NEW HAVEN, CONN.



American Machinist

Hardened steel taper pin finished and fitted 5 min.

Here's A Little Trick The Landis Grinder Does,

does it in the right way, and as easy as rolling off a log, in just five minutes by the clock. It doesn't require an expert to do this little trick on a Landis Grinder, in such quick time. Any mechanic of ordinary skill can do it without laying a hair. And when it comes to making a large number of pieces exactly alike—not "pretty near," but EXACTLY—there's no other machine of any sort that can compete for a minute with the Landis Grinder. That's strong talk, but it's intended to be taken seriously, for we can produce the proofs.

SEND FOR THE GRINDER BOOK.

LANDIS TOOL COMPANY,

WAYNESBORO, PA., U. S. A.

Walter H. Foster, Manager, New York. Hill, Clarke & Co., Boston and Chicago. C. W. Burton, Griffiths & Co., London. Ad. Janssens, Paris and Brussels. Schuchardt & Schuette, Berlin, Cologne, Vienna, Brussels, Stockholm and St. Petersburg.

THE ONLY TAPPING ATTACHMENT

THAT HAS STOOD THE TEST OF TIME IN ACTUAL SERVICE.

Combines all that can be desired in such a tool.
Can be used in any machine having a revolving spindle.

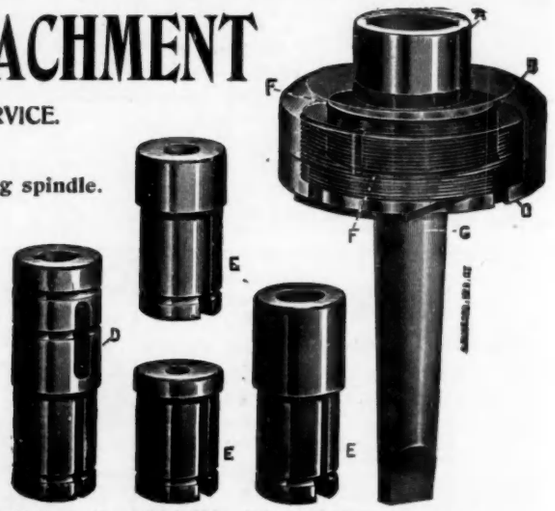
IT IS SIMPLICITY SIMPLIFIED.

Nothing to break, nothing to wear out.

Effects an ENORMOUS saving in TIME.
Effects an ENORMOUS saving in LABOR
Effects an ENORMOUS saving in COST.

WORK DONE ACCURATELY, QUICKLY, WELL.
CAN YOU AFFORD TO BE WITHOUT IT?

Yours on trial if desired—at least inquire about it.



BEAMAN & SMITH, Providence, R. I.

Makers or users of Tapping Devices, NOTICE!
Any tapping device transmitting power through a friction of any kind is an infringement of our patents.